the OIL AND GAS JOURNAL
PUBLISHED WEEKLY April 4, 1960

New UOP process offers flexibility ▸ 66

California swimming in waste water ▸ 70

Italians hit in the Persian Gulf ▸ 80

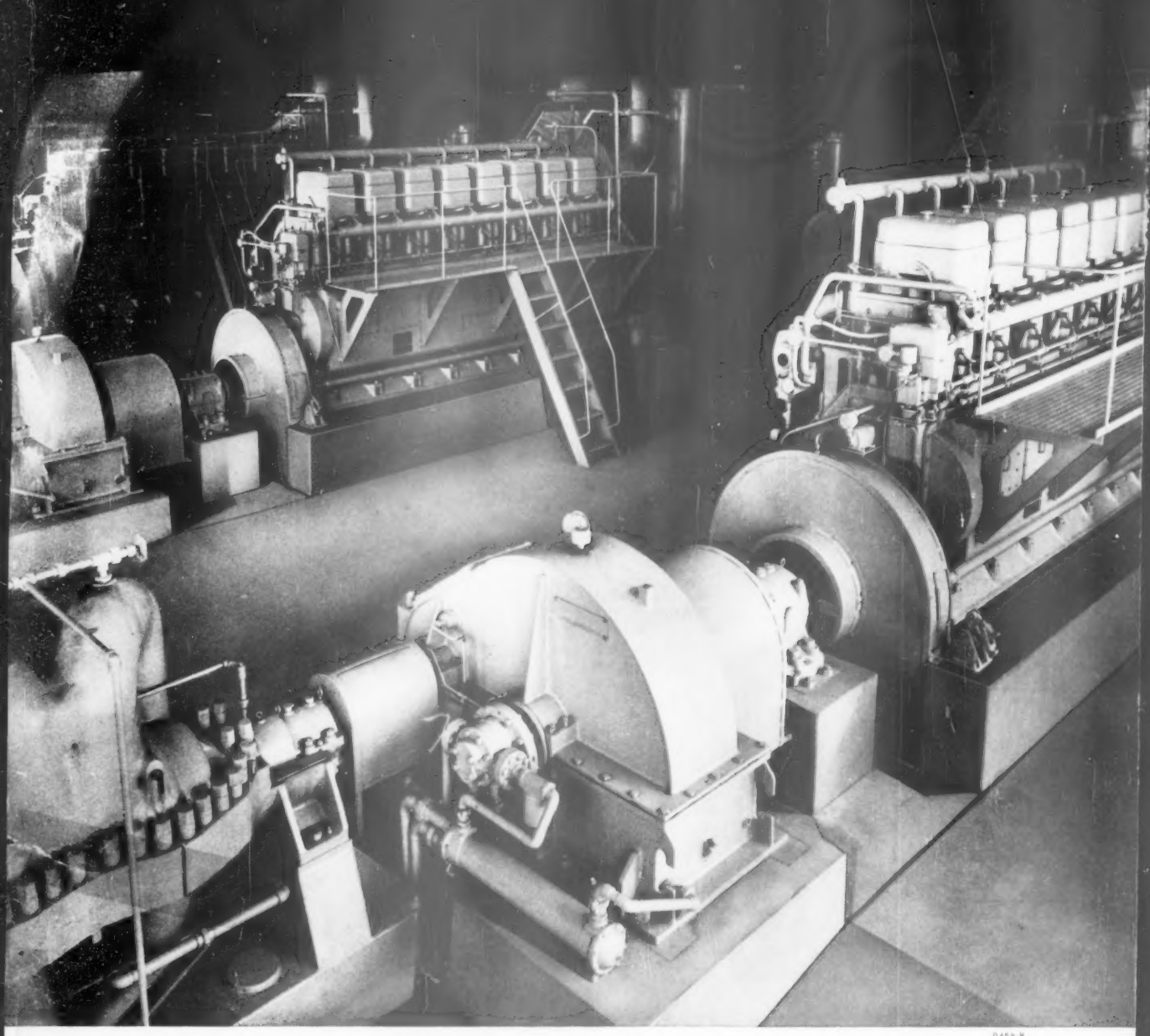
Strain-gage study aids pipeline design ▸ 92

A fresh look at

THE 1960 DRILLING PICTURE

Here's what really happened to first-quarter drilling, and how operators now view prospects for the remainder of the year.

p. 61



0459-R

Pipe line engines by Nordberg

Unattended, remote control operation of six Nordberg engine-pumping units is an important feature of the Evangeline Products Pipe Line System. Three Nordberg 1720 horsepower, four-cycle engines are installed in two identical, full satellite pumping stations on the 16-inch products line.

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OIL AND GAS JOURNAL
Vol. 58, No. 14

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TECHNOLOGY—OPERATION

Drilling

IDC's Desert Rig Is Moved In Six Packages 86

By Ed McGhee

International Drilling Co.'s big Rig 15 was put together for operation in the remoteness of the North African desert where highways don't exist. This means there are no weight limitations on the units into which rig machinery may be packaged. Largest load amounts to 112,000 lb. on the tandem. Rig 15's design makes it fast and easy to get these huge packages out of and back into operation.

Petrochemical

Dow's New Plant Serves North Central States 90

The Saginaw Bay operation uses straightrun refinery products as feed stock. Petrochemical products include ethylene, propylene, and butadiene. Some ethylene is sent to the nearby polychemicals plant for conversion into liner polyethylene.

Pipelining

Strain Gages Determine Secondary Stresses on Pipelines 92

By George McClure

Ten gas-pipeline companies have carried out a cooperative experimental stress-analysis program at selected points on their own pipelines. Field installations have been made at about 30 individual locations and some are in operation after as much as 3 years. Data obtained are expected to provide for a major step forward in pipeline design.

Save Money with X-52 Welded Repairs 121

By T. A. Ferguson

Tests indicate that the theoretical yield point of pipe isn't reduced by welding of defects which fall within the commonly defined limits.

Production

Chemical Inhibitors Combat Paraffin Deposition 97

By C. F. Parks

Field tests using new paraffin inhibitor show that deposition can be eliminated, or effectively retarded in wells treated with the chemical. Downhole equipment must be clean for effective application.

Refining

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Indexes on construction and operating costs.

Quarterly Costimating Report 100

Itemized cost indexes for refinery chemicals, equipment, and materials of construction.

Questions and Answers on Cat Cracking 102

Here are portions of a discussion at a regional meeting of the Western Petroleum Refiners Association in El Dorado, Ark., at which experts answer questions on all phases of refining.

Putting Linear Programing to work 114

By John E. Chenevey

Part 3 of three parts. The optimization of one of Continental Oil Co.'s smaller refineries was the first linear programing study of a complete refinery undertaken by the company. Part 1 of the series outlined the solution technique in general terms. A sample problem was worked out in Part 2.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
April 4, 1960

Drillers need spell of good weather:

Industry has chalked up one of worst first quarters in years for drilling.

Completions are off 1,452 from 1959. Oklahoma alone is 529 wells off and West Texas 444.

Rotary-rig activity for March averaged 1,667, lowest since 1947. First-quarter average was 1,676, also a 13-year low.

Oil men over country tell Journal editors (p. 61)* causes for downturn are:

...Bad weather which has put real crimp in operations in North Texas, Oklahoma, and Kansas.

...Low allowables and purchaser proration which have choked down income which feeds drilling in Texas, Oklahoma, Louisiana, and Kansas.

...Lack of red-hot drilling prospects throughout the Southwest and Mid-Continent.

However, majors still insist they'll drill as many wells as they projected last fall—almost as many as they drilled last year. And independents, off to a slow start, also say they'll make up for lost time.

▼ ▼ ▼

Fear of crude-price cut is causing some operators to take a close look at drilling plans.

That's why current spate of crude cuts on Gulf Coast are being watched so closely. Southern Minerals last week met competitors by posting cuts ranging from 5 to 15 cents. The 5-cent cut was on 27,000 bbl. of light crude and the 15-cent cut on 3,000 bbl. of heavy in Corpus Christi area.

Continued erosion on Gulf Coast spread last week to Arkansas, with 10-cent cuts in Stephens and Horsehead crudes.

Look for a merger of WPRA and NPA, possibly before the year is out. Private sentiment in both organizations favors

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

move. New group might be known as National Petroleum Refiners Association.

WPRA President W. J. Carthaus said last week at WPRA meeting merger has been suggested to WPRA board. Committee was authorized to make study. Another study is being made by Booz, Allen & Hamilton, Chicago.

Two associations have 24 members in common today.

Magnesia again is being considered in fluid cracking catalysts. Interest was revived last week by WPRA paper on pilot-plant results. American Cyanimid said it had solved biggest problem with magnesia in the past—regeneration.

New catalyst hasn't been tested commercially. It contains 20% alumina and 3% magnesia on a silica base. It promises higher yields of gasoline, propylene, and butylenes and offers higher gasoline octanes and reduced coke and dry gas.

First commercial test will be made by Shell this year.

Other WPRA notes: UOP disclosed a new refining process, Lomax. New hydrocracking process offers flexibility in gasoline or middle distillate yields (p. 66). Sinclair said it has found a way to get more precise results from tests using knock engines. Luminosity was emphasized as an important new factor in jet-fuel performance.

▼ ▼ ▼

Major extension of Albion-Scipio trend looms in southern Michigan at McClure-Fulk 1 Winter in Calhoun County.

Well flowed oil to pits for 10 minutes on drill-stem test of Trenton dolomite at 4,158-236 ft. Location is 3 miles northwest of developed area at Albion, until now the farthest northwest productive point in 25-mile long play.

Other tests in last month virtually assure connection between the Scipio and Pulaski and Pulaski and Albion pools, all on the same trend.

Colorado portion of Paradox basin has first significant discovery since Northwest Lisbon last year.

Nabers 2 Rowley in Montezuma County, 12 miles east of Utah's Ismay field, flowed 40 bbl. of oil in 5 hours on 4/64-in. choke from Ismay Pennsylvanian at 5,399-419 ft.

Discovery lies 12 miles northeast of Colorado's Flodine Park field.

Drilling notes: Gulf ran into a tough problem in its deep test off Key West. Coral formations were so porous Gulf couldn't cement casing. It solved problem by running canvas sleeve to line the hole and hold cement (p. 69).

Socony Mobil will drill at least 25 wells in the Gulf this year. President Albert Nickerson says recent bids brought Socony holdings in Gulf to 124,000 acres. Company also plans

12 wildcats, 8 development wells in Libya. Other plans: Sell all but a few rigs and contract wells; abandon exploration in Portugal, France, Colombia and spend more in Libya, Tunisia.

Crooked holes are saving money, API meeting in Wichita was told. Sohio man says average time in Garvin County, Okla., was cut from 225 to 135 days by letting bit drift. Continental reports time on 7,300-ft. wells cut from 115 to 50 days. Such savings make risks attractive, they say.

▼ ▼ ▼

Texas has come up with a new definition of a discovery well. Distance from production isn't enough. Operators wanting discovery allowables must now submit evidence that they've really tapped a new reservoir (p. 79).

Something new in unitization is being tried in California. Agreements adopted for Fault Blocks 2 and 3 in Wilmington field contain some unusual provisions (p. 68).

Humble is moving its marketing into Ohio. Since "Esso" brand name can't be used there, marketers are eager to see what will be adopted. It could be a clue to brand name Jersey will adopt in nationwide marketing plans (p. 72).

Foreign notes: Italy's ENI may have 3,500-bbl. discovery in Persian Gulf off Iran. If reports are true, well gives Italians their first Middle East oil, long sought by ENI chief Enrico Mattei (p. 80).

In Latin America, Paria Operations reportedly has found two thick pays in Gulf of Paria. Confirmations or extensions have been made in two Lake Maracaibo blocks (p. 82).

Latest Journal survey of world production shows free-world production outside U. S. topped 10 million barrels for the first time in January (p. 85).

▼ ▼ ▼

Increasing California problem is disposal of waste water. Since 1946, water cut has climbed from 57.9% to 72.7% of all produced fluids. Operators now must get rid of 2,224,000 bbl. of water daily. Problem is worse because of spread of urban and farm developments into even remote oil areas (p. 70).

New twist in automotive field: Ram induction. Chrysler says it works like a supercharger, has no moving parts. Best virtue is extra power for passing without affecting economy of normal driving. System uses sonic impulses in manifold tubes to push air and fuel into cylinders (p. 65).

Commercial scout checks are increasing. New one will begin operation in Midland and Roswell June 1. Idea is now being studied in Oklahoma (p. 79).

OIL AND GAS JOURNAL

Market Memo

April 4, 1960

Prices and price attitudes are firming. At least, they are in some places on some products.

Refiners seem to be abandoning the attitude that Macy's must meet Gimbel's prices. On the Gulf, prices are up at some points, down at others. Here's the spot picture:

Gasoline: ½ to ¾ cent off postings for prompt lifting. A major bought a T-2 of 98-Research gasoline last week at ¾ cent off posted prices from an independent for prompt lifting.

No. 6: Demand picking up and prices firming. Some major East Coast buyers are caught with their residual down. They exhausted their import quotas too early. Several, it's said, would take cargoes from the Gulf.

Distillates: No. 2 is easy at ⅜ to ½ cent off posted prices with no buyers in sight. Refiners with storage figure they can crack this into gasoline and make more than by selling distillate at these figures. Late-season demand is bringing middle-distillate inventories closer to normal.

▼ ▼ ▼

River markets aren't in as good shape as the Gulf. Most sellers have posted prices, but they'll sell at big discounts to their friends—and the sellers are more friendly than the buyers.

One friendly seller offers spot gasoline at ⅜ cent off the Gulf but will go to ¾ off to get the business. Another is offering spot gasoline at ⅜ cent off plus 1% discount. It takes ⅞ cent off the Gulf Coast low to get into Chicago from the river, and sales have been made at this price.

Excessive gasoline stocks in the Illinois-Indiana-Kentucky area are the big deterrent to higher river prices.

▼ ▼ ▼

The incremental barrel is losing popularity. In the end, crude is worth what it brings in products. And to a crude-deficit refiner, there's no such thing as an incremental barrel.

At the WPRA meeting refiners were in agreement—without conspiring—on one thing: A few weeks of crude runs at 80% of capacity would solve the problem they created by making more material than the market would absorb.

After all, said one, Macy and Gimbel's bargain-basement sales aren't year-round affairs.

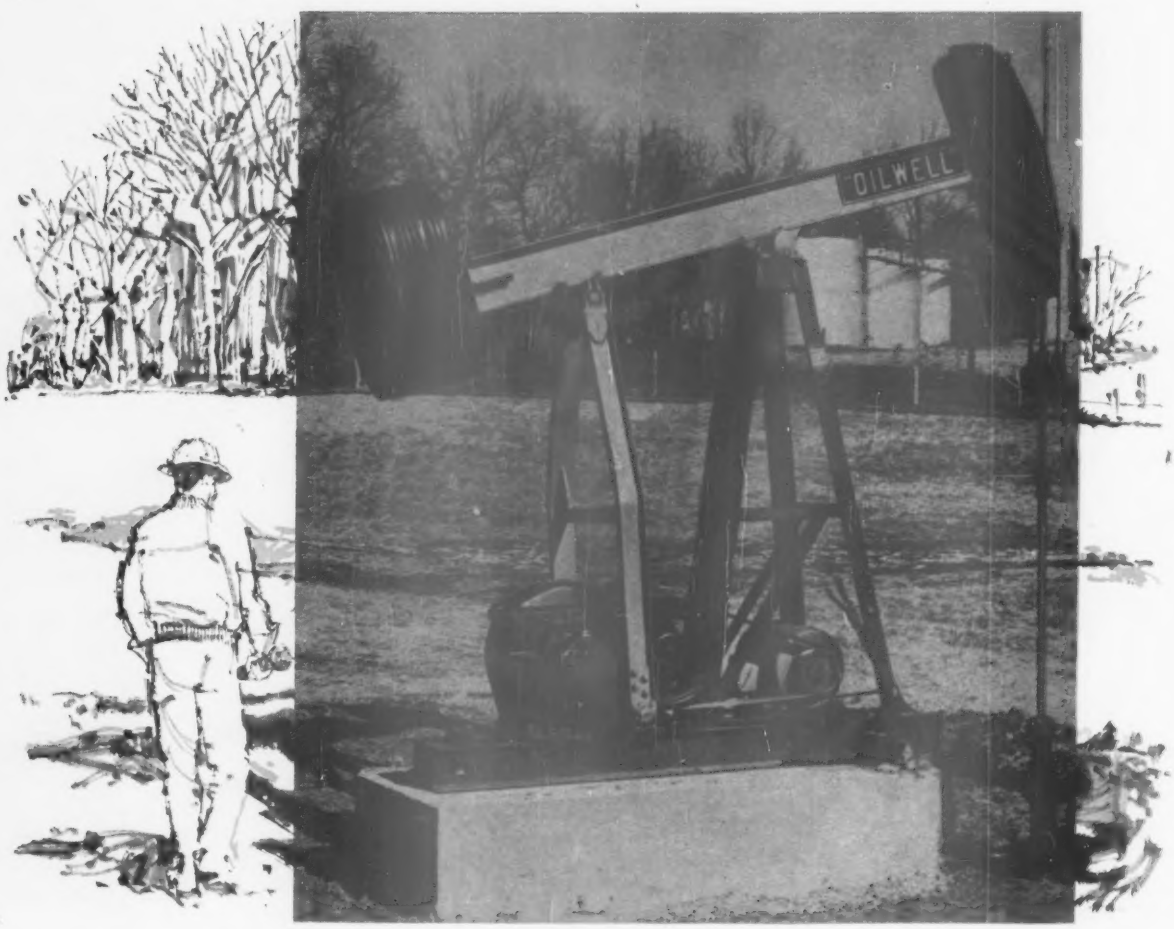
YOU CAN USE A LARGER SHAFT WHEN YOUR "SPECS" READ HYATT

Need a larger shaft without disturbing envelope dimensions? Take advantage of a Hyatt option by omitting the inner race. You can add the thickness of the Hyatt inner race to the shaft and let the rollers operate directly on shaft. Just be sure that the shaft is suitably hardened and ground. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

Replacement bearings available through United Motors System and its authorized bearing distributors.

HYATT HY-ROLL BEARINGS

IN ROLLER BEARINGS HYATT IS THE WORD FOR GM RELIABILITY



"Oilwell" 25L3 Pumping Unit in Green County, Kentucky.

Small size—big output . . . "Oilwell" 25L3 Pumping Unit

This modern unit has a *long stroke* that gets large volume with a lighter beam load. You can use rod-type pumps and get the same number of barrels as from tubing pumps using equal horsepower. Round trips are cheaper because only rods have to be pulled and not tubing.

"Oilwell" 25L3 units can be furnished with an internal combustion engine drive, or with an electric motor drive directly beneath the samson post, as shown. Effective counterbalancing is provided by inexpensive slab-type weights on the extended end of the walking beam. Adjustment is easy and sure. Why not get the full story from the nearest "Oilwell" store?

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This hose keeps the joints from jumping

B.F.Goodrich hose still on the job after 5 years and 52 wells

FIVE years ago that B.F.Goodrich vibrator hose went into action on a new rig operated by the Howard Parker Company, Houston, Texas. When the picture was taken, the hose had already drilled 52 wells with footage of about 540,000 feet and handled some 800 million gallons of mud—and was still going strong.

This hose was specially developed by B.F.Goodrich to keep the terrific vibration of the slush pump from shaking off connections. It's so flexible that it absorbs the destructive vibrations, can't be jarred loose—yet it's so tough it lasts for years. It can be loaded onto trucks, moved from job to job, dragged into position without fear of damage—the thick, tough rubber cover resists gouges, scrapes, tears. Sun, wind and rain won't weaken it. Spiral-wrapped cable wires make it resistant to bursts.

The tube of this B.F.Goodrich hose is smooth so mud can flow through at high speed without appreciable pressure drop. The tough rubber resists abrasion; oily mud will not cause it to swell or rot. Hose ends are reinforced to protect against bending stress at the couplings.

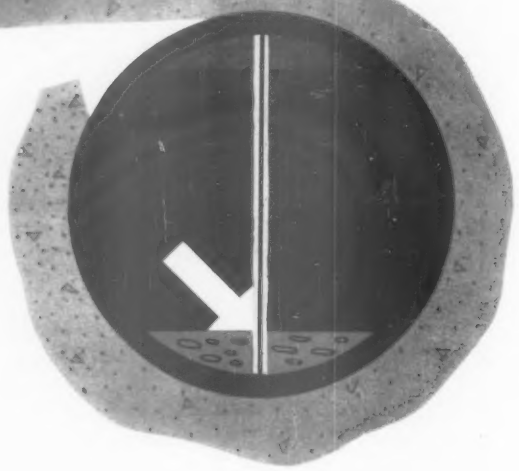
You'll find this longer-lasting B.F.Goodrich hose at leading supply stores in the oil-fields, or at any of these B.F.Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Hobbs, Oklahoma City, Tulsa, Dallas, Houston, Odessa, Wichita Falls. *B.F.Goodrich Industrial Products Co., Dept. M-810, Akron 18, Ohio.*

B.F.Goodrich

"PAY-ZONE" PROTECTION

PRIMARY CEMENTING...

by HALLIBURTON



The primary cementing job is the most important factor influencing the "pay-out" of your well when a promising pay-zone is realized.

For dependable well-life for years ahead... *primary cementing* by Halliburton gives you more advantages and protection for a long-term profitable operation.

HERE'S HOW OPERATORS ADD UP THE ADVANTAGES OF HALLIBURTON PRIMARY CEMENTING:

- For protection and conservation of possible oil producing zones
- For protection against the migration of water, oil or gas from one formation to another
- For protecting casing from corrosive fluids
- For reducing the danger of contamination
- For aid in controlling high or low pressure zones

It will pay to look into these advantages further—whether it's today or tomorrow—when you're ready for successful primary cementing... you're ready for Halliburton!

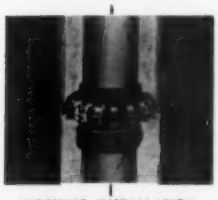
HALLIBURTON TOOLS:

PRIMARY FACTOR IN SUCCESSFUL CEMENTING

HALLIBURTON AUTOMATIC FILL-UP EQUIPMENT

Simple design, operational ease and greater economy are features of Halliburton Automatic Fill-Up Float Collars and Float Shoes. These precision tools save running-in time of casing; minimize damaging pressure surges; convert to Super Seal Floating when tripped by moderate increase of circulating pressure and fluid volume using a conventional rig pump. These double-action units have orifice metering that measure the flow of drilling fluids while running casing. The durable nose guide of high strength concrete helps guide casing easily to bottom.

RECIPO WALL CLEANER



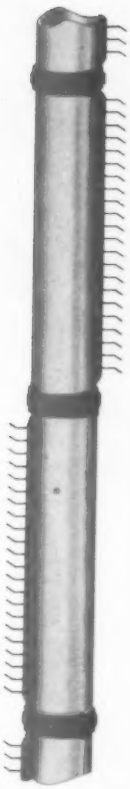
WORKING INSTALLATION

HALLIBURTON RECIPO WALL CLEANER

A low cost tool for helping to remove filter cake from the wall of the bore to allow better bonding of cement to the formation and casing. As shown in the top illustration, the tough, flexible rubber fingers minimize damage to the bore hole and filter cake while casing is being run. When casing is reciprocated, these fingers fold back, thoroughly cleaning the wall of the bore. The special design of this tool provides wide fluid passage areas between the fingers to help reduce circulating pressures and help prevent bridging action of the loosened filter cake. The tool is hinged for quick, easy installation.

HALLIBURTON ROTO WALL CLEANER

By comparison the most effective and efficient mud-cake remover in the field. The horizontal rotating action of this tool decreases lost circulation problems as mud-cake is undisturbed through porous formations while running. Stronger, tighter and more enduring results in primary cementing are attained to help form a more durable bond between cement and bore wall, greatly reducing remedial jobs.



ROTO WALL CLEANERS INSTALLED WITH EZ LOK LIMIT CLAMPS

HALLIBURTON EZ LOK LIMIT CLAMP

A new limiting device with superior locking power handles heavy loads exceeding 20,000 lbs. in either direction when positioning auxiliary equipment like that shown on this page. It provides double savings because initial cost is low, and it eliminates welding of limiting devices to casing. It is hinged for fast, easy installation either on the pipe rack or when lowering the string into the hole.

HALLIBURTON CEMENT BASKET

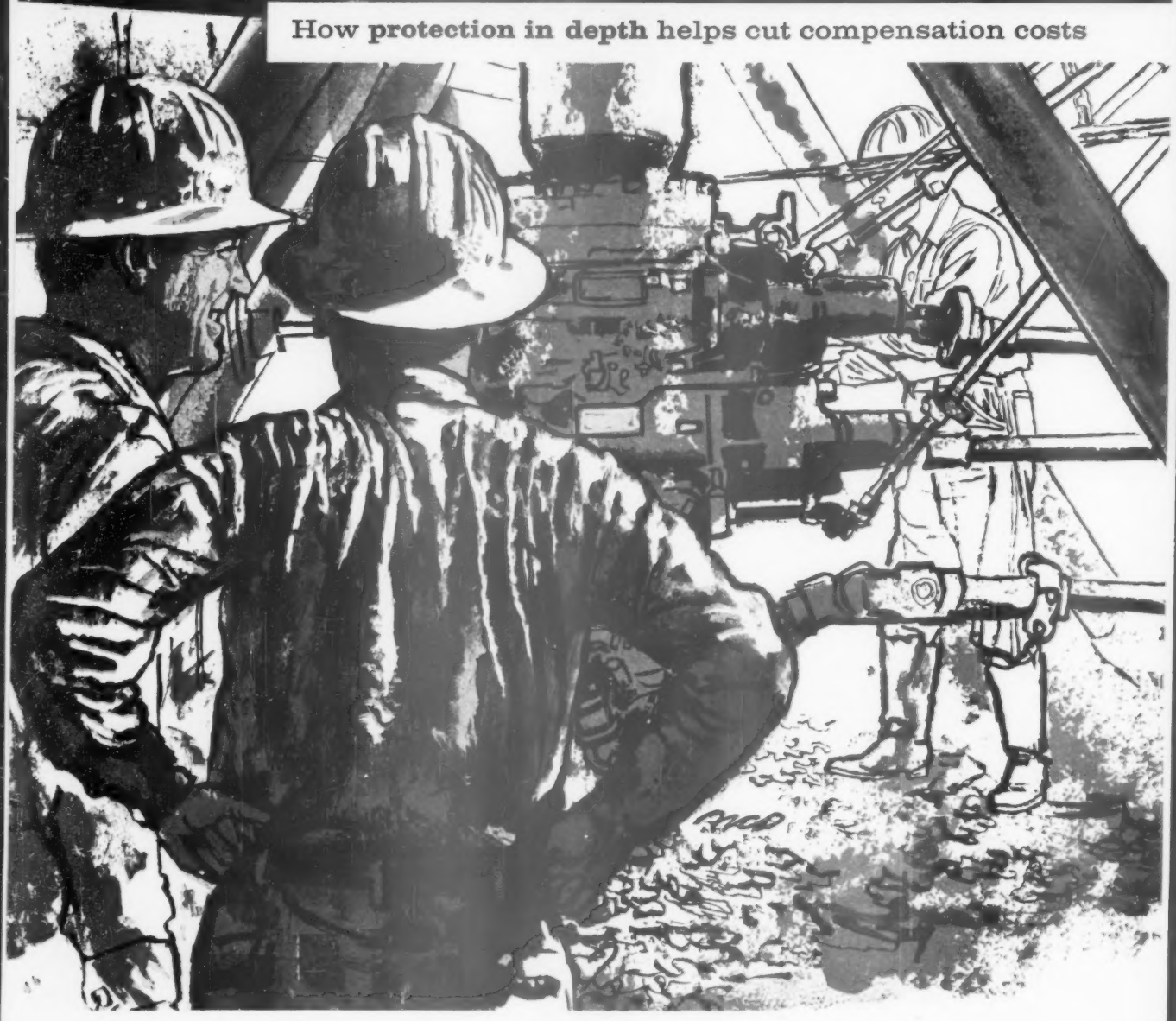
Successfully used in primary cementing to help protect weak formations and retain cement by reducing slurry loss and breakdown of porous formations. Run outside of the casing or liner above defective formations, the basket acts as a support after cement is pumped and "bridges" heavy cement columns until initial set.

HALLIBURTON CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

275 SERVICE CENTERS—JUST MINUTES AWAY FROM YOUR WELL

How **protection in depth** helps cut compensation costs



How well are your men equipped to handle a blowout?

A well that kicks can be the forerunner to disaster. How swiftly and effectively your crew on tour reacts largely determines the outcome. Are these men trained for a blowout emergency? Liberty Mutual engineers help the pusher and drillers in their training program. They check blowout preventers, fire protection equipment and review the emergency procedures. This thorough check-out is but one of the many Liberty Mutual services that add up to protection in depth. To learn more about Liberty's protection in depth and how it can help lower your business insurance costs, just get in touch with the Liberty Mutual office nearest you.

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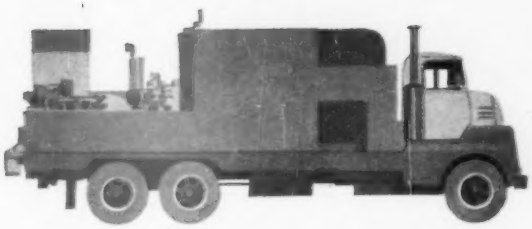
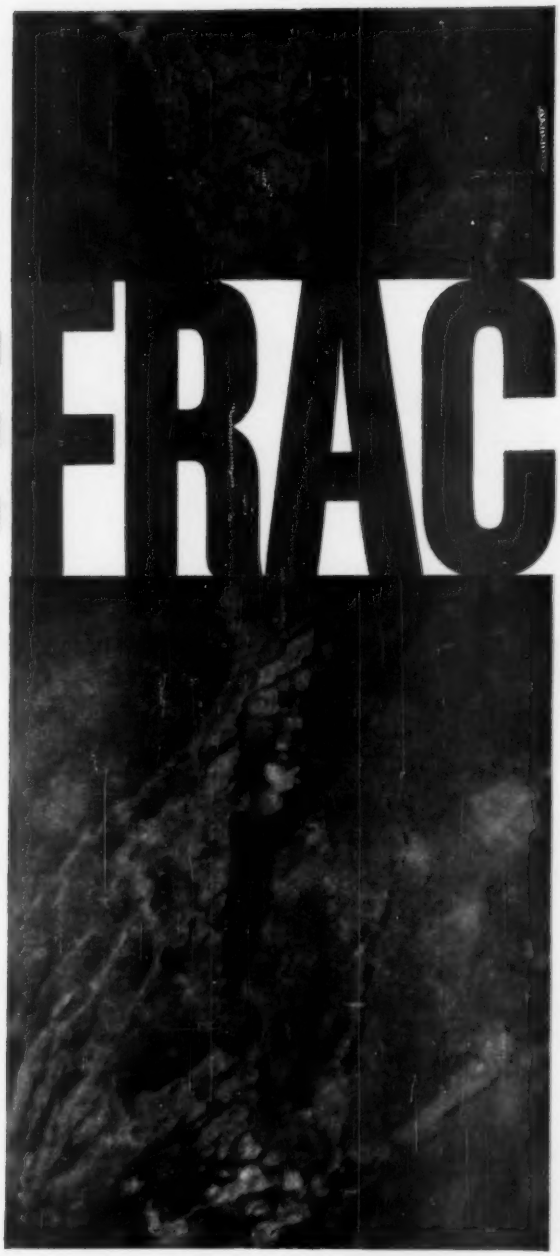
LIQUID HUMBLEFRAC CONCENTRATE



FOR BETTER FRAC JOBS



HUMBLEFRAC CONCENTRATE is a liquid-type fluid loss additive that can be accurately measured into the fracturing oil to obtain the optimum blend. With HUMBLEFRAC CONCENTRATE more of the fluid remains in the fracture system, to extend the fracture and allow propping sand to be placed.* It increases the sand-carrying capacity of the fluid. HUMBLEFRAC CONCENTRATE contains no solids to harm conductivity of the fracture, or to cause permeability damage. Return of frac fluids is quick and complete. HUMBLEFRAC CONCENTRATE is available in 14 and 55 gallon drums and in bulk. For complete technical information, call your Humble salesman or contact Humble Oil & Refining Co., Houston, Texas.

HUMBLE

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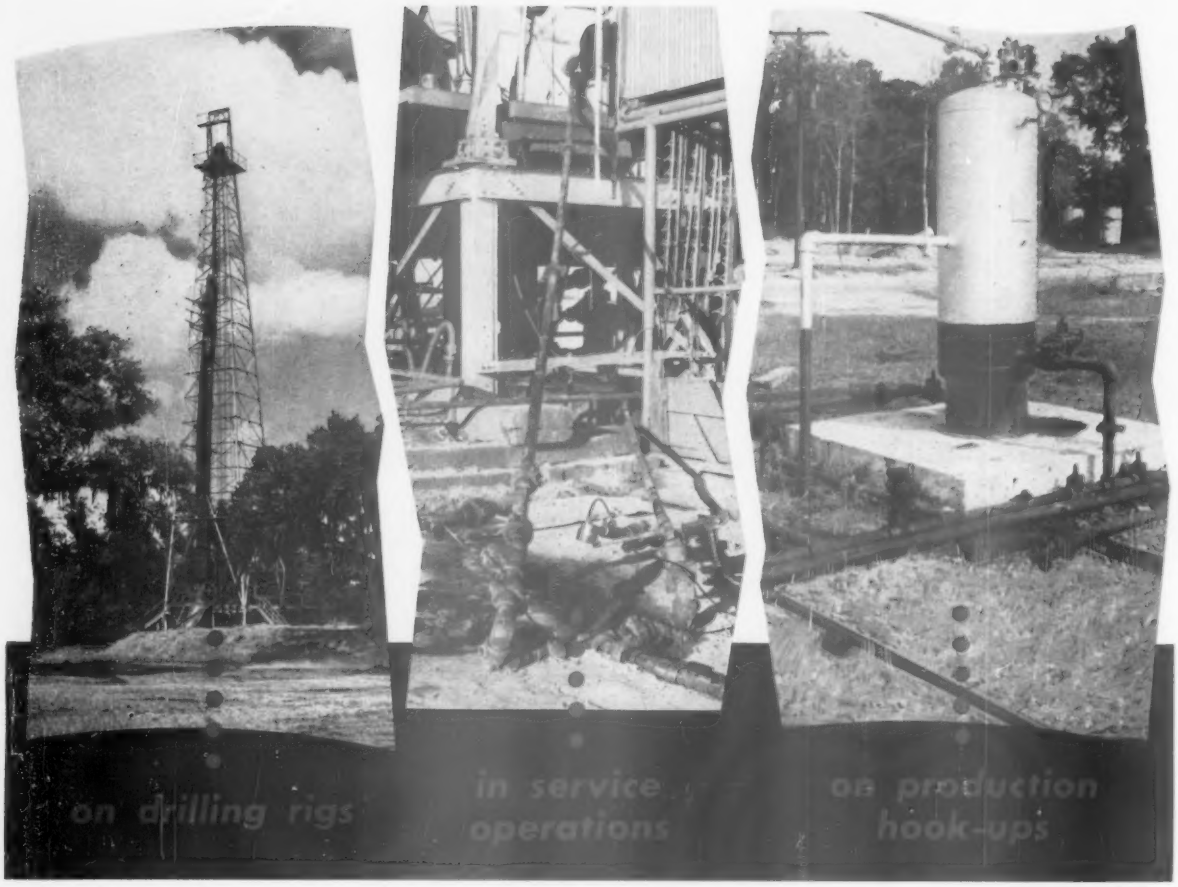
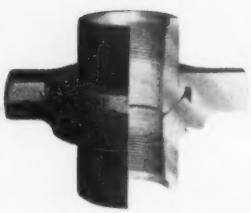
* HUMBLEFRAC CONCENTRATE has been tested and proved in actual reservoir rock cores and in the formation, *where it counts*, not in artificial filter paper tests.



WECO UNIONS *mean greater service and economy*



Quality keynotes the design, engineering and manufacturing of WECO unions to give you better unions wherever they are needed in oil field operations. On the drilling rig, WECO unions mean faster rigging-up with greater assurance of dependable leak-proof piping. In service operations you rig-up fast and know that with WECO unions on the job you can handle the high pressures, high volumes and heavy abrasives of cementing, acidizing and sand fracturing without danger of leaks. When setting tanks, treaters, separators, installing field headers, manifolds and other production piping, WECO unions save time, and trouble.

There's hardly a place in the oil field where you won't benefit by standardizing with WECO unions. Sizes, pressure ratings and types for every service assure the right union for the service regardless of operating conditions.

Ask your WECO representative to help you plan a program of standardizing with WECO unions on your drilling rigs, your service trucks and equipment, your production installations. You'll save money in the long run.

U-3-60

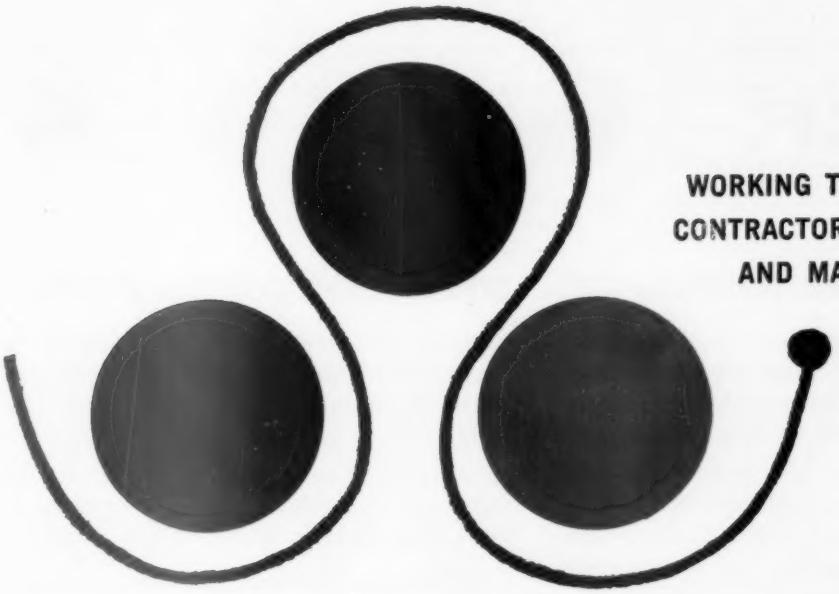
WECO® **WELL EQUIPMENT MFG. CORP.** fmc®
HOUSTON, TEXAS
Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

WECO UNIONS

CHIKSAN SWIVEL JOINTS

HAMER LINE BLIND VALVES

HAMER PLUG VALVES



WORKING TOGETHER... CONTRACTOR, PRODUCER, AND MAGCOBAR

plan mud programs for pay and profit

High drilling costs can be cut by efficient use of drilling fluids. The right drilling chemicals, **used right** by Magcobar engineers, can help increase penetration rates, save on trips and bits, reduce materials needed, and save on equipment and manpower.

But, to make sure that the mud program is the most efficient, it must be planned from the beginning. And, because it must deal with so many specifics, it can be developed only with the close cooperation of producer, contractor, and Magcobar engineer. A sound mud program must be based on product performance, formations to be drilled, and, very important, type of equipment to be used. By working together, a planned mud program can be developed to make full use of the money-saving advantages of Magcobar Technology. This Technology formulates special drilling fluids to reduce or prevent damage to the pay, resulting in quicker completion, higher production, and less need for expensive stimulation work. Magcobar Technology can help you as a contractor to drill wells more cheaply, can help you as a producer to have better wells. Drill your next wells with Planned Mud Programs with Magcobar.

Magcobar
Complete
DRILLING MUD SERVICE

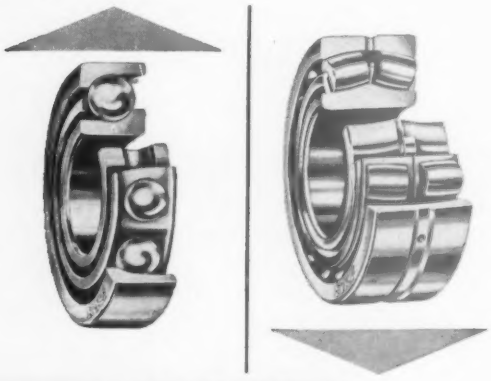
EVERY TYPE—EVERY USE
SKF
INDUSTRIES, INC., PHILADELPHIA 32, PA.

Spherical, Cylindrical, Ball, "Tyson" Tapered and REED Miniature Bearings

ANGULAR CONTACT BALL BEARING

This is the bearing to use when you need a high-speed bearing to support either (a) heavy thrust load, or (b) thrust load combined with radial load. It lends itself to various mounting arrangements. For example, if you need axial rigidity and high radial capacity you can mount two of these bearings in pairs either face-to-face or back-to-back. Or, if very high thrust capacity is needed, you can mount two or more of these bearings in tandem.

This standard bearing is available in over 80 sizes of single- and double-row types. Bore sizes range from ¾" to just over 7".



SPHERICAL ROLLER BEARING

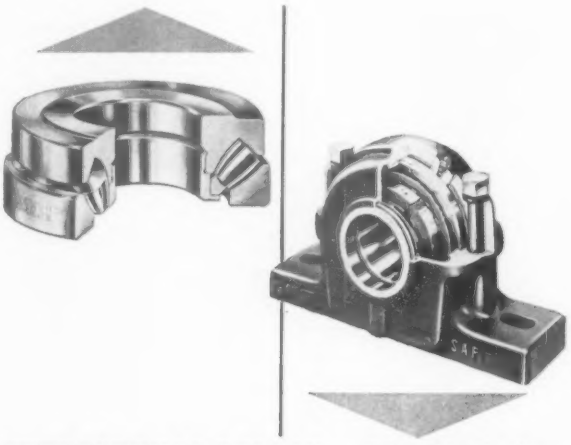
SKF invented the spherical roller bearing almost forty years ago. Since then, we've improved the original design several times—so that, today, our Type "C" spherical roller bearing offers longer life and 33⅓% greater capacity.

This increased capacity is largely due to the number, size and shape of the rollers—and the improved accuracy with which they're guided. Because these bearings are inherently self-aligning, their full capacity is always available for substantial thrust load in either direction as well as heavy radial load. These bearings also have special lubricating grooves that channel lubricants directly to the spherical rollers.

SPHERICAL ROLLER THRUST BEARING

Need a thrust bearing capable of carrying unusually heavy loads? Then specify this self-aligning spherical roller thrust bearing. It will carry either heavy thrust or combined thrust and radial loads. Because of its ability to carry high thrust at high speeds, this bearing is frequently chosen over large angular contact ball bearings for heavy-duty applications.

SKF makes this bearing in twenty-five standard sizes ranging from 4.3" to 14.9". And it's competitively priced.



TYPE SAF PILLOW BLOCK...with self-aligning ball or spherical roller bearings

Here's a rugged cast-iron pillow block that provides high efficiency with low friction.

We make this split pillow block with ball bearings for normal loads and with spherical roller bearings for heavy loads. We also equip it with Triple-Seal rotating rings that effectively protect the bearing from abrasives and corrosives, and prevent oil or grease from leaking out.

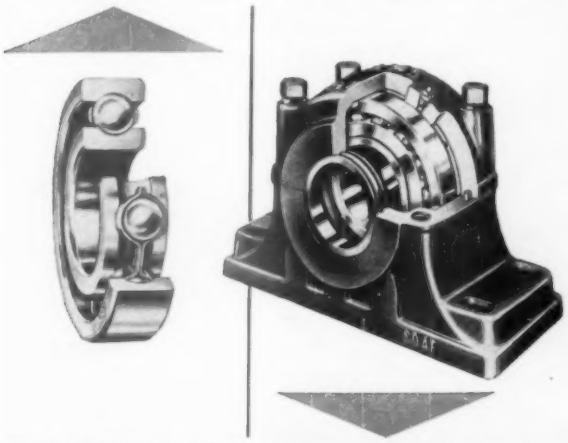
This pillow block can be mounted directly or with an adapter. Stabilizing rings are provided at no extra cost for applications where a "held" bearing is required to maintain shaft location. For heavy-duty applications, a cast steel housing (Type SAFS) is available. Shaft sizes from ¾" to 10½".

Only SKF can offer you unbiased bearing recommendations—because only SKF produces all four major types of anti-friction bearings: spherical, cylindrical, ball, and tapered roller bearings. For complete details on each type, just call the nearest of the twenty-four SKF sales offices.

SINGLE-ROW DEEP-GROOVE BALL BEARING

Here's a ball bearing that does two jobs, and does both of them well. It sustains heavy radial load as well as thrust load in either direction. Not only that, this bearing can be grease-lubricated when used at normal speeds and lubricated with oil at high speeds.

Yet this is a standard SKF bearing, mass-produced in various sizes at our automated Altoona (Pa.) plant. It's available in over 100 sizes ranging from over 5/8" O.D. to almost 16" O.D., and with various seal, shield and snap-ring combinations.



TYPE SDAF PILLOW BLOCK...with spherical roller bearings

Need an exceptionally sturdy pillow block? One that can withstand abnormal shock loads or heavy thrust loads day after day? Then specify SKF Type SDAF.

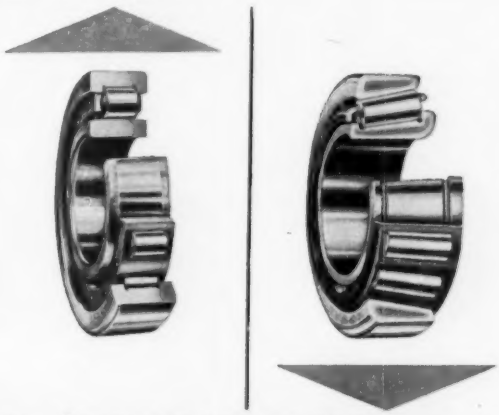
To provide maximum strength, four heavy bolts secure the cap of this pillow block to the base. Both halves are accurately aligned by dowel pins. And like the Type SAF, this pillow block comes equipped with Triple-Seal rotating rings that protect the bearing from foreign matter and retain the lubricant.

Type SDAF pillow blocks are made of cast iron but are also available in cast steel (specify Type SDAFS). They can also be mounted directly or with an adapter. Shaft sizes range from 2-11/16" to 14".

CYLINDRICAL ROLLER BEARING

Got a space problem? Here's a bearing that gives you high radial capacity—at very high speeds—in relatively small space. It's the SKF cylindrical roller bearing—which provides high radial capacity and minimum shaft friction. Controlled shaft end float within this bearing is a natural advantage of its design.

You can get prompt delivery in 154 bore sizes ranging from just under 1" to 6". Double-row cylindrical roller bearings are also available in bore sizes from 1" to 9.5".



Tyson* TAPERED ROLLER BEARINGS

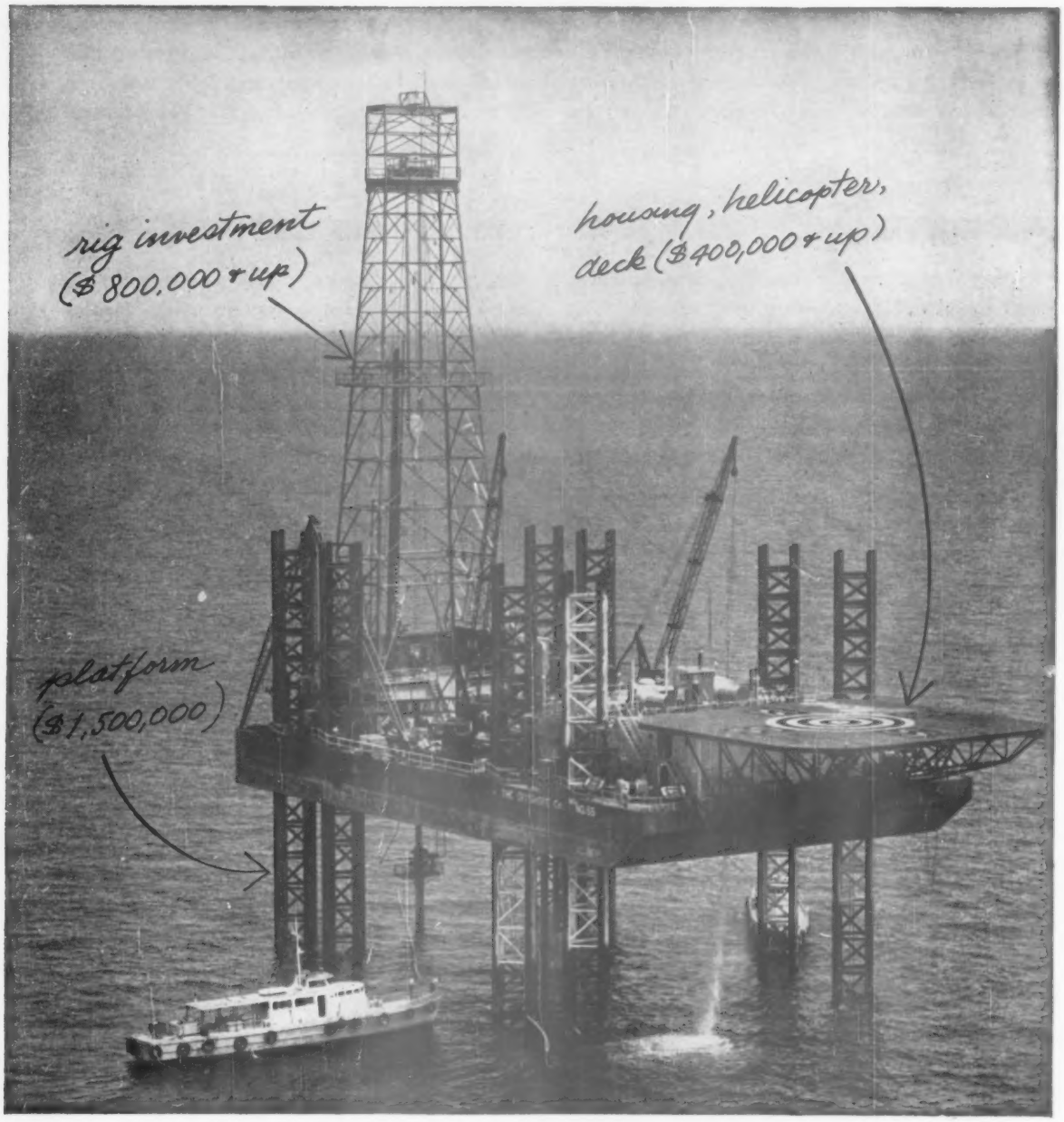
What type of tapered roller bearing do you need: single-, double- or four-row? SKF's division, Tyson Bearing Company, makes all three of these types in a wide range of standard sizes.

The single-row type is especially suitable for carrying radial loads simultaneously. Double-row types are designed for use where the radial capacity of two single-row bearings is required. For special applications, the four-row type offers very high radial capacity in limited space.

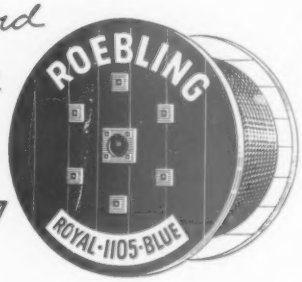
All Tyson tapered roller bearings are interchangeable, size for size, with other makes of tapered roller bearings where the part numbers are the same.

5949

*REG. U. S. PAT. OFF.



When you spend $4,000,000 for an offshore rig you can't afford not to use the best rope



You wouldn't use Bargain Basement bits. **You'd get the best.** You'd get the best of everything; that's why an offshore rig can run as much as $4,000,000.

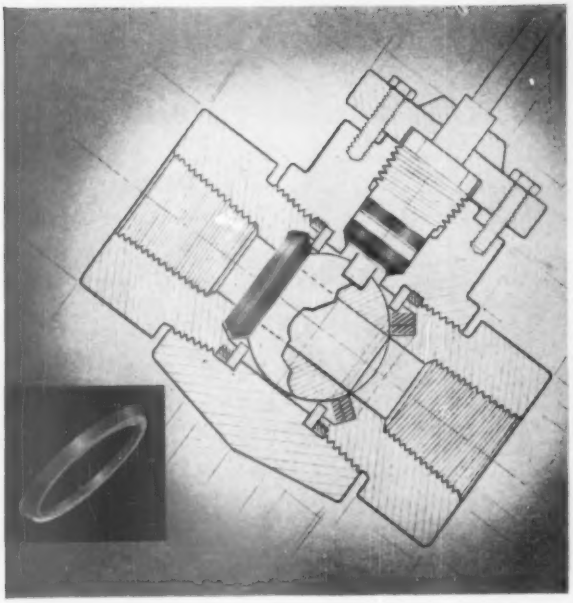
To settle for anything less than Royal Blue at this stage would, indeed, be "pound foolish." For Roebling **Royal Blue** Wire Rope represents in *its* field, the finest there is.

It is made from the toughest rope wire ever produced—Type 1105—extra high-strength improved plow steel. Royal Blue has all the hard-working advantages of preformed construction; outstanding resistance to abrasion, fatigue, impact, crushing and shock; exceptional flexibility and ruggedness. Collectively, these values add up to 15% more strength than in any other rope you have ever used.

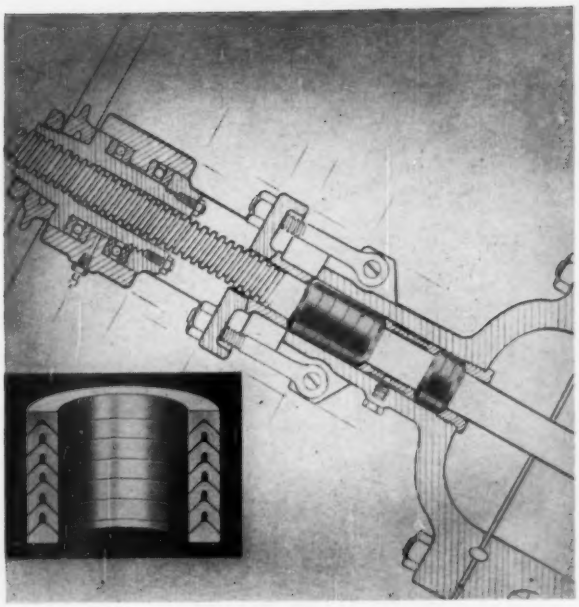
Anything less than Royal Blue can cost you *more*. Your distributor has Royal Blue right now. Get it now and save and save and save. For information on Royal Blue, write Roebling's Wire Rope Division, Trenton 2, N. J.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation



Seats and stem gaskets of TFE resin assure tight-sealing, no-stick operation in these non-lubricated ball valves used in high-pressure butane-propane service. These valves have been in operation for three and one-half years, with no leakage or valve failure.



V-ring packings of a TEFLON TFE resin in valves for paper-mill service eliminate the frequent changes of packing and periodic adjustments formerly required. In addition, losses of corrosive liquor are eliminated and wear on valve stems is sharply reduced.

Maintenance and replacement costs reduced with packings and gaskets of TEFLON® TFE resins

The two examples above typify the cost-cutting advantages of TEFLON fluorocarbon resins as packing and gasket materials. In all applications TEFLON resins provide long service life . . . with resultant savings in maintenance and replacement costs, plus increased productive capacity due to less downtime. TEFLON resins are not affected by materials being processed. Their low-friction characteristics often permit their use without lubrication, minimize torque requirements, and reduce wear on pistons and shafts.

TFE resins are the established standards where reliability over a wide range of severe conditions is important. They are rated for continuous service at 500°F. FEP resin is the new melt-processible member of the family of TEFLON fluorocarbon resins. It can be molded and extruded like nylon, polyethylene and other familiar resins. FEP resin is capable of continuous service at 400°F.

In many applications, TEFLON fluorocarbon resins have been found to be the only material that would give satisfactory performance. But even when service demands are not exceptionally rugged, the properties and versatility of TEFLON TFE and FEP resins permit plant-wide standardization for packings and gaskets in petrochemical service.

For more information about the wide variety of forms in which TFE and FEP resins are available for sealing applications, consult your supplier. And for additional information about properties and characteristics of TEFLON resins and the many ways they have led to improved, economical designs, write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department T-3044, Room 2526, Nemours Building, Wilmington 98, Delaware.

• • •

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

DU PONT REG. U.S. PAT. OFF.

TEFLON®

FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resin.

How Leading

Drilling Contractors Cut Costs

Competition in the contract drilling industry was never keener. Drilling contractors must find new ways to lower their operating costs if they are to show a profit.

It is significant that many of the leading drilling contractors depend on equipment sold and serviced by Jones & Laughlin Supply Division. These leaders discovered long ago that lower first cost did not always mean lower final cost. They know they must use equipment that will give them more performance hours per dollar invested. This is why you'll find quality drilling equipment sold by Jones & Laughlin on the job for these industry leaders.

Backed by J&L service with field stocks of expendable supplies and replacement parts, these drilling contractors have cut their costs consistently.

Quality equipment and dependable service can lower *your* operating costs, give you the edge on competition. See your local J&L man today.

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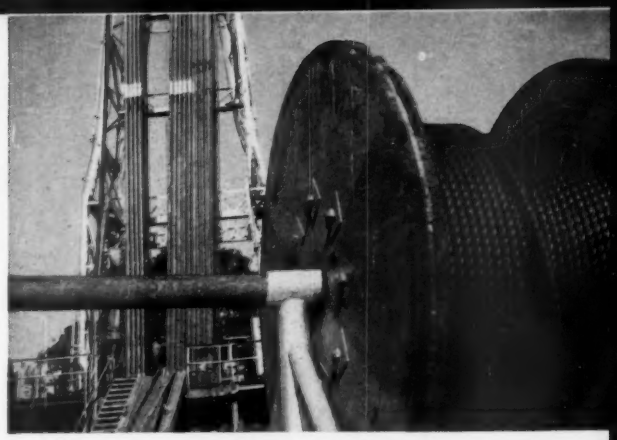
SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available 101



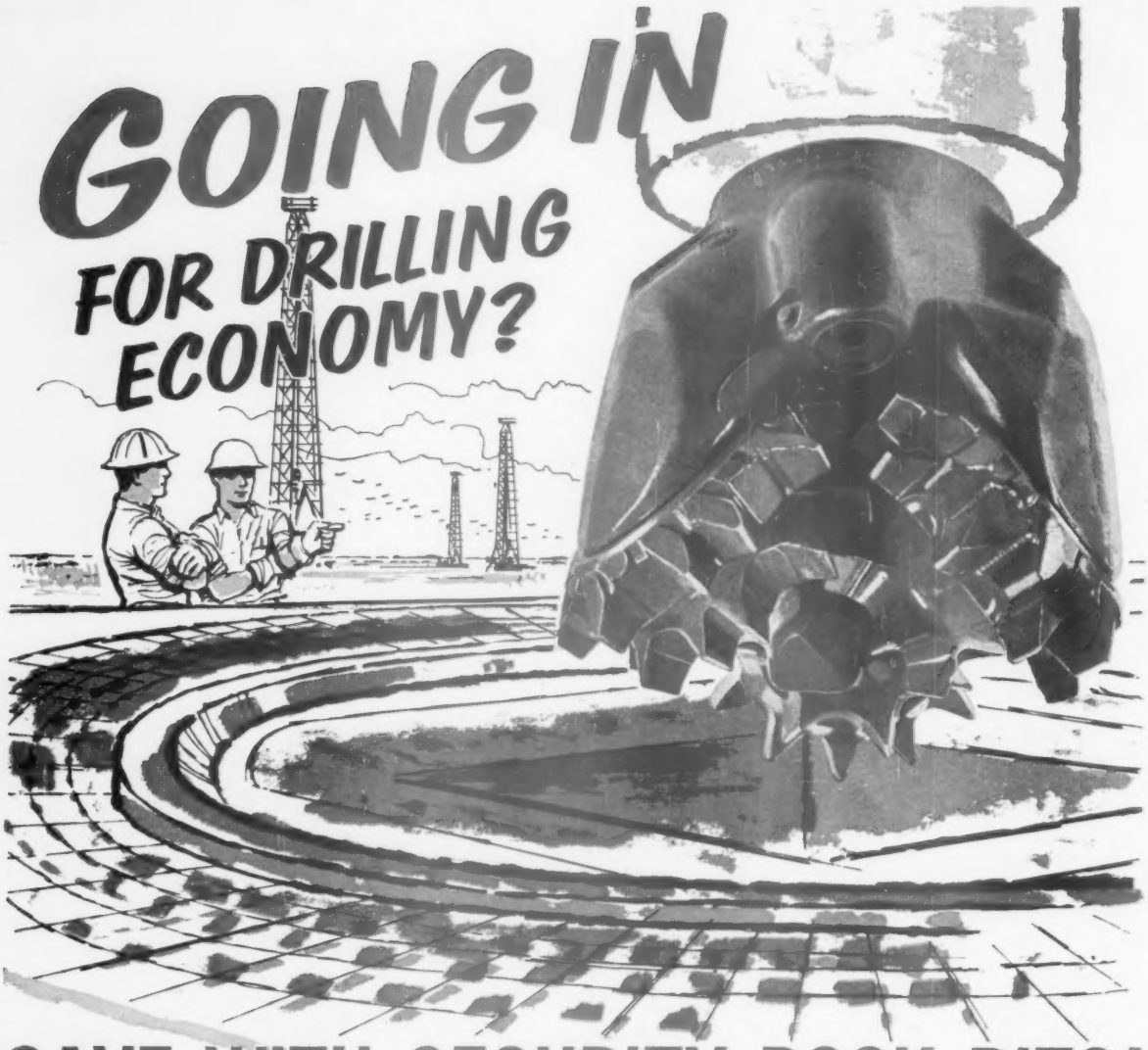
Because of unusual quality in materials and construction, J&L Wire Rope gives more ton miles. Result: Lower operating costs per foot of hole.

Three Gardner-Denver Mud Pumps on a well in Mississippi. Replacement of all Gardner-Denver parts can be made in the field, and these parts are as near as your J&L Supply store.

No tools needed to lay your temporary galvanized steel lines with McDowell "Fast-Line" Couplings. You save up to 80% installation time. Ask for illustrated booklet.

J&L's quality Blue Ribbon Drill Pipe is preferred by the drillers of the world's deepest wells. The J&L quality control program is the most exacting known. Ask your J&L Supply man for a beautifully illustrated 24-page booklet on oil country tubular goods.

GOING IN FOR DRILLING ECONOMY?



SAVE WITH SECURITY ROCK BITS!

Around the world, Security rock bits repeatedly set performance records resulting in outstanding drilling economy. You too can *save with Security because:*

Security rock bits are the product of advance research, design, metallurgy, quality control and field application engineering.

Security rock bits are manufactured to precision standards on specially-designed machinery calibrated to exacting tolerances.

Security rock bits are furnished in 1120 types, sizes and variations — right for every formation and drilling requirement.

Drill with Security and save! Write for our 1960-61 model and specification catalog today.

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STABILIZERS • CASING SCRAPERS

DRESSER INDUSTRIES INC.
OIL • GAS
CHEMICAL
ELECTRONIC
INDUSTRIAL

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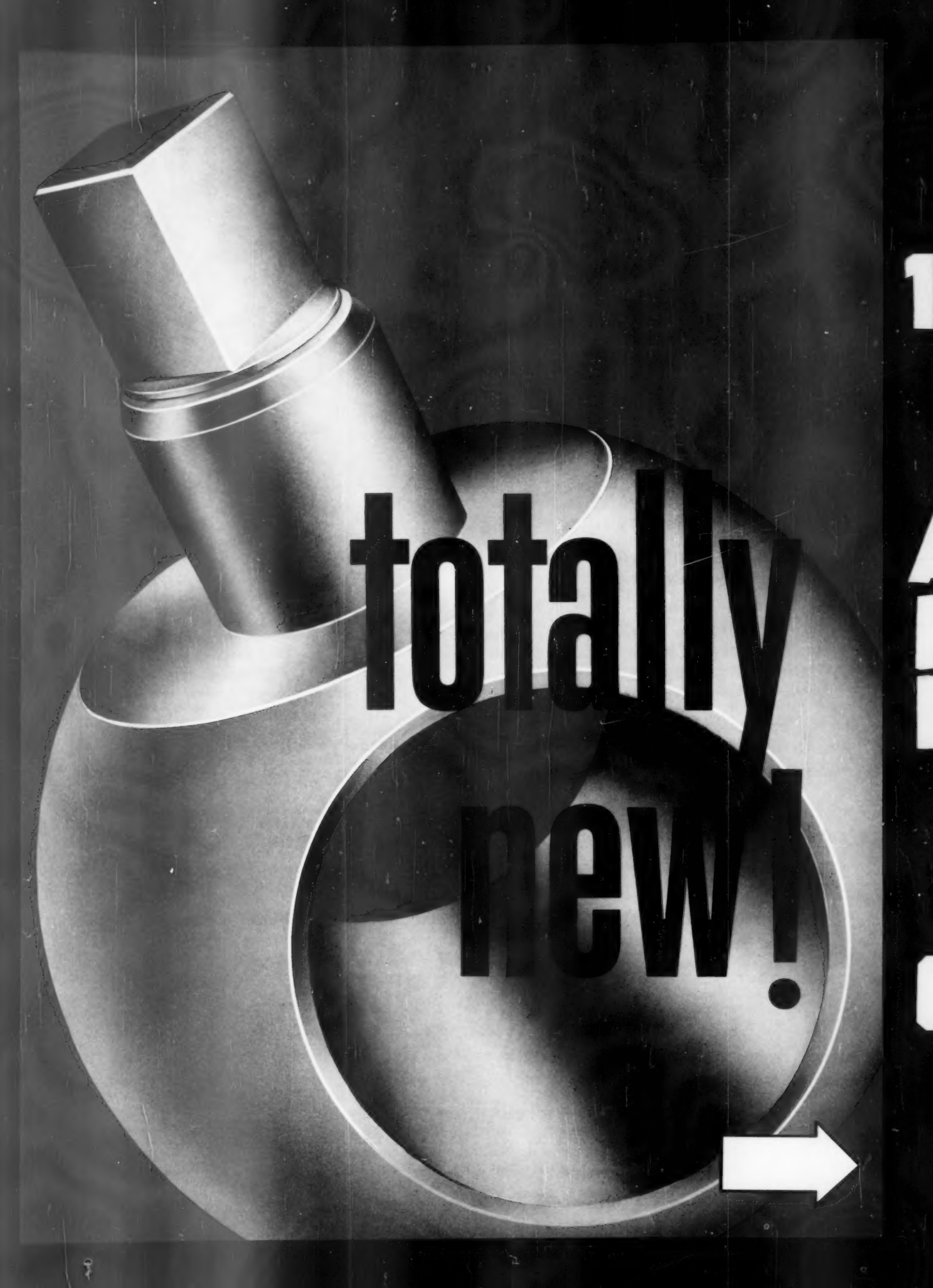
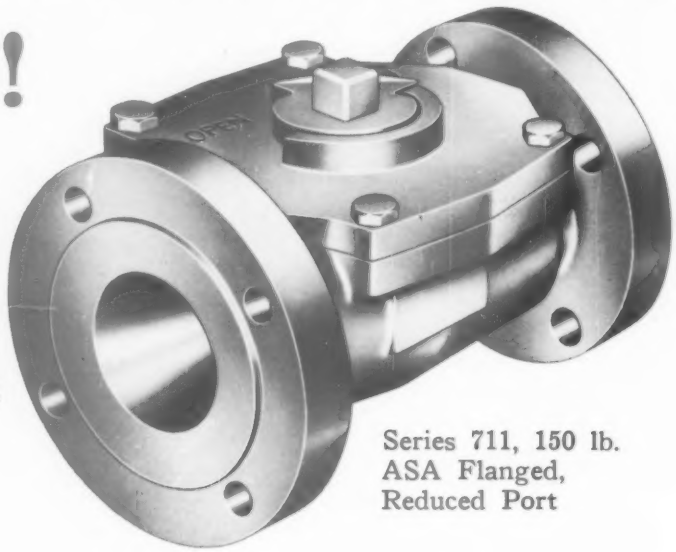
SECURITY ENGINEERING DIVISION... 3400 W. Illinois, Dallas, Texas
EXPORT OFFICE... Post Office Box 13647, Dallas, Texas
CANADA... Security Engineering Canada, Ltd., Edmonton, Alberta, Canada
OVERSEAS... Security International C. A., Caracas, Venezuela; London, England


totally
new!

Only *FLO·BALL* valves are bearing-fixed for maintenance-free long life!

. . . with all the features you must have:

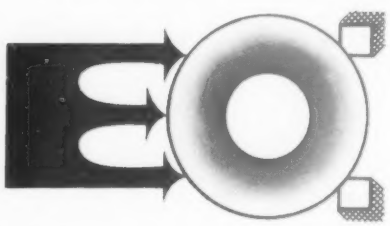
- **Top loading**
- **Replaceable seats**
- **One-piece ball and stem**
- **90° on-off**
- **Two-way flow**



Series 711, 150 lb. ASA Flanged, Reduced Port

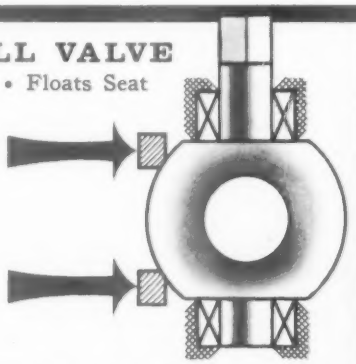
Now available . . . the result of years of intensive service in the missile-space industry . . . proven in thousands of adverse applications . . . now at mass produced prices . . . the most advanced line of ball valves ever manufactured . . . for you!

ORDINARY BALL VALVE
Floats Ball • Fixes Seat



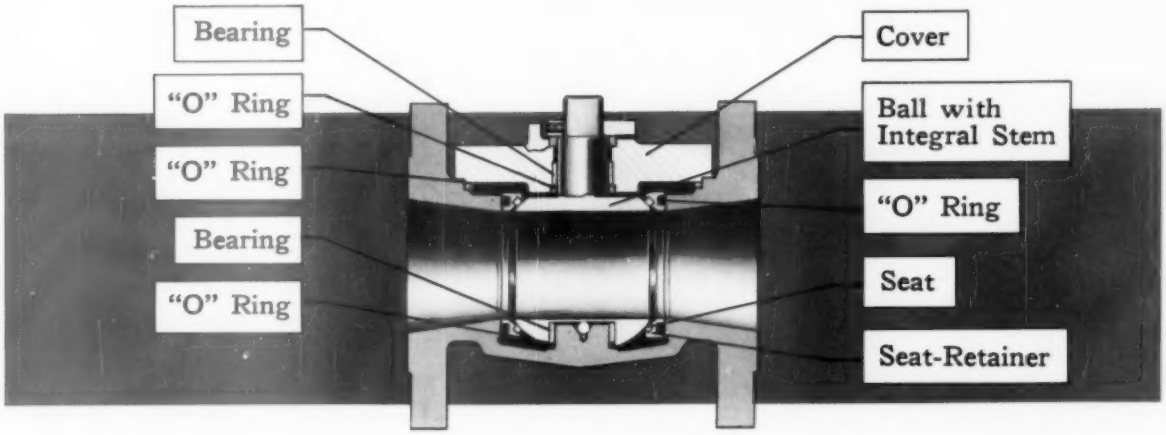
Floating ball puts excessive pressure load on fixed seats. Results in distortion and short life.

FLO • BALL VALVE
Fixes Ball • Floats Seat



FLO·BALL bearings absorb all pressure forces. Elimination of excessive seat loading insures long life.

The Series 711 ***FLO·BALL*** valves are available for off-the-shelf delivery. Manufactured to standard ASA dimensions in carbon steel, 316 stainless steel, and aluminum for body and ball, Teflon for seats, and Buna "N" O-Ring seals. Other materials are also available. These valves operate at pressures to 300 psi, temperatures to 400° F.



The Hydromatics Series 711 FLO•BALL valve gives you the features you must have!

- Bearing-Fixed ball. Engineered to withstand shock and impact without distortion or backlash.
- Top loading. Valve can be disassembled and assembled without removing it from line. No special tools are required.
- Self adjusting, replaceable seats. Both balanced seats are self-aligning and self-adjusting for controlled seat loading and positive seal.
- No lubrication. Operates completely without lubrication.
- Zero leakage. At all operating pressures, including vacuum to 10^{-6} mm. of Hg.
- One-piece stem and ball. Simplified construction adds strength, precision and lower torque.
- Maximum flow efficiency. The open ***FLO·BALL*** valve provides an unrestricted, straight-thru fluid path.
- Lowest torque. Bearing-Fixed construction results in effortless, fast-action with low torque.
- Two-way flow. Exclusive ***FLO·BALL*** seat design principle insures perfect seal in both directions.

Hydromatics, Inc.

FLO· BALL

Mail this postage-free card today

Tear Along This Edge

Gentlemen:
Your Bearing Fixed Flo·Ball valves from ⅛" to 24" may help solve a problem relating to the control of:

☐ Corrosive Liquids ☐ Cryogenic Liquids ☐ Throttling Flow
☐ Vacuum ☐ High Pressure

My flow problem is_____

_____

I now use Ball Valves in these sizes_____

PLEASE: ☐ Have salesman call ☐ Send technical data

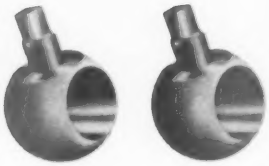
My name_____ Position_____

Company name_____

Address_____

City_____ State_____

Bearing fixed

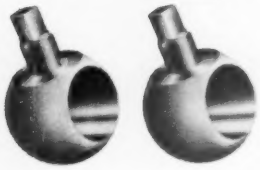


New Zero leakage

Maximum flow

Top loading

New



No lubrication

One piece ball and

stem

New

Hydromatics, Inc.

LIVINGSTON, N. J. • WYMAN 2-4900 • TWX = LIVINGSTON, N. J. 120

BUSINESS REPLY MAIL
Postage Will Be Paid By

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PERMIT #40
LIVINGSTON
NEW JERSEY

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FOR SAFETY YOU CAN SEE REMEMBER THE "V" FOR VISIBLE BLADES!

• The men who pull the switches will tell you what can happen when a switch, *believed* to be open —*isn't*. A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on **V**isible **B**lade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because *Square D switches have never been out of first place in more than 50 years!*

They cost no more... why settle for less?

MAIL the coupon for latest Safety Switch Bulletin

Square D Company, Dept. 5A-129
1601 Mercer Road, Lexington, Kentucky

Please send me your latest SAFETY SWITCH BULLETIN

NAME_____

COMPANY_____

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CITY_____ ZONE____ STATE_____

SQUARE D COMPANY

wherever electricity is distributed and controlled

REPUBLIC IS READY...

READY WITH

LIGHT WALL!

This newest kind of electric weld line pipe is available from Republic in 1.315″ THROUGH 4.500″ O.D.!

Republic has it—electric weld line pipe that saves you up to ⅓ the weight, ⅓ the cost. Of special interest for low pressure gathering and distribution applications, Republic Light Wall is manufactured to applicable parts of API Specification 5L, in sizes from 1.315″ through 4.500″ O.D.

Light wall pipe is joined by welding or by light wall pipe fittings. Or, pipe may be grooved for Victaulic Couplings. Republic X-TRU-COAT can be supplied in all sizes of light wall pipe.

YOUR REPUBLIC SALESMAN has complete details. Get in touch with him today or write Republic Steel Corporation, Dept. OG-9291, 1441 Republic Building, Cleveland 1, Ohio.

REPUBLIC LIGHT WALL LINE PIPE (BLACK) PLAIN END

Size O.D.	Weight Per Ft.	Wall Thickness	Test Pressures PSI Grade A	Grade B
1.315	.868	.065	1800	2000
	1.092	.083	2300	2500
	1.403	.109	2500	2500
1.660	1.107	.065	1400	1600
	1.398	.083	1800	2100
	1.805	.109	2400	2500
1.900	1.274	.065	1200	1400
	1.611	.083	1600	1800
	2.085	.109	2100	2400
2.375	1.60	.065	1000	1100
	2.03	.083	1300	1500
	2.64	.109	1700	1900
2.875	2.47	.083	1000	1200
	3.67	.125	1600	1800
3.500	3.03	.083	900	1000
	3.46	.095	1000	1100
	4.51*	.125*	1300	1500
	5.58*	.156*	1600	1900
	6.63*	.188*	1900	2200
4.000	3.47	.083	700	900
	3.96	.095	800	1000
	5.17*	.125*	1100	1300
	6.40*	.156*	1400	1600
	7.65*	.188*	1700	2000
4.500	3.92	.083	700	800
	4.47	.095	800	900
	5.84*	.125*	1000	1200
	7.25*	.156*	1200	1500
	8.64*	.188*	1500	1800

*Sizes made to API Standard 5L, latest edition.

All other items are manufactured to applicable parts of API Standards 5L, latest edition.

REPUBLIC STEEL

Electric Weld • Fusion Weld • Continuous Butt Weld • Light Wall • X-TRU-COAT • Plastic Pipe

Bending goes ahead without interference from dozer blade, which remains ready for use.

BEND PIPE...STRETCH DOLLARS

with this JOHN DEERE *Blade and Sideboom* Outfit!

The John Deere 300 Sideboom with Pipe Bender and 301 Bulldozer Blade:

Rated Lift Capacity, 4 ft. from boom pivot, 3000 lbs.

Pipe Bender Capacity: 2-, 3-, 4-, 6-, or 8-inch pipe.

Bulldozer Blade Width, 78 inches; Lift, 22 inches.

From the day the trench is opened, to the minute the backfill is in, this versatile John Deere Sideboom outfit works any gas distribution job. Not only handles a good variety of work itself, but steps right into spots too tight for many bigger outfits.

Wherever you use this John Deere "440"—in congested city work, or on those long feeder runs in new neighborhoods, you'll save with its fuel economy, simple maintenance requirements and the extra strength that's built into every part. Both wheel and crawler models are available, and you can select these with either gasoline or Diesel power.

See your John Deere Industrial Dealer about specifications and prices.

John Deere Industrial Division Dept. 545, Moline, Illinois

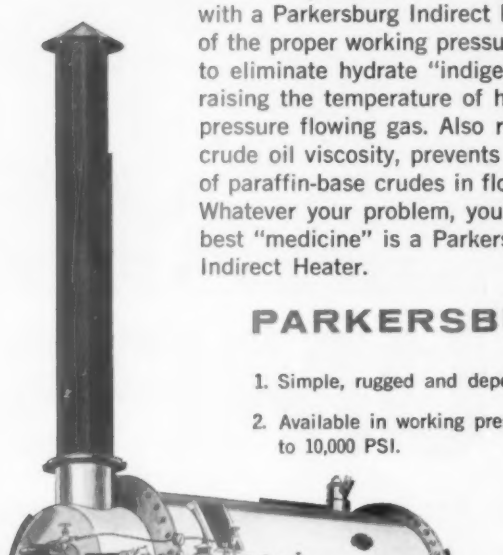
JOHN DEERE

"Specialists in Low-Cost Power with a Heavyweight Punch"

℞

"INDIGESTION AID" for high-pressure flowlines

Let your Parkersburg man be your "medicine man" in treating hydrate formation problems. He can provide you with a Parkersburg Indirect Heater of the proper working pressure and size to eliminate hydrate "indigestion" by raising the temperature of high-pressure flowing gas. Also reduces crude oil viscosity, prevents congealing of paraffin-base crudes in flowlines. Whatever your problem, your best "medicine" is a Parkersburg Indirect Heater.



PARKERSBURG Flowline Indirect Heaters

1. Simple, rugged and dependable controls.
2. Available in working pressures from 3,000 PSI to 10,000 PSI.
3. Blowout-proof burner and pilot.
4. Standard sizes to 4,000,000 BTU/HR. Larger sizes upon application.

SEE YOUR PARKERSBURG MAN TODAY!

THE PARKERSBURG RIG & REEL COMPANY
Division of Parkersburg-Aetna Corp.
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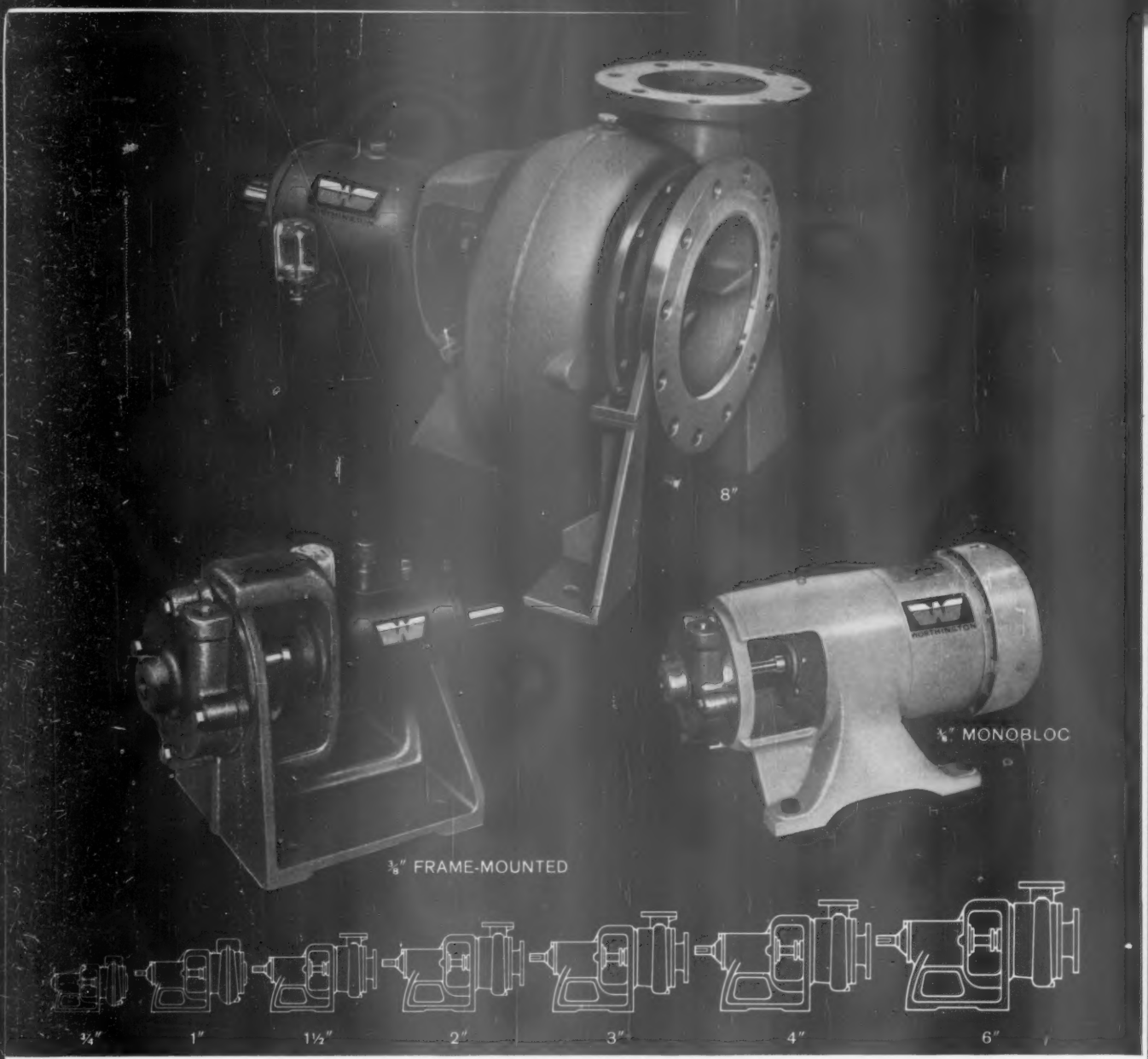
PARKERSBURG—The FULL LINE in Pressure Vessels . . . Separators, Metering Equipment, Treaters, Heaters, Knockouts and Oil Skimmers, Scrubbers, Hyrecos, Dynamic Adsorption Units, Glycol Dehydrators, Stabilizers.



3 NEW PUMPS

make Worthite your broadest choice for corrosive applications

Worthington has recently added new pumps at the top and bottom of its Worthite* line.

These new sizes mean you can order standard Worthite centrifugal pumps in capacities up to 4000 gpm and heads up to 275 feet.

New ⅜″ Pump—Available in both frame mounted and Monobloc designs, the ⅜″ pump is designed for continuous, 24-hour-a-day service. The rugged frame and shaft is actually the same physical size as the larger ¾″ and 1″ pumps. All liquid end parts are precision cast. Oil lubricated bearings are standard (although grease lubrication is available.) In short, this pump will give long, trouble-free life and outlast 2 or 3 ordinary units.

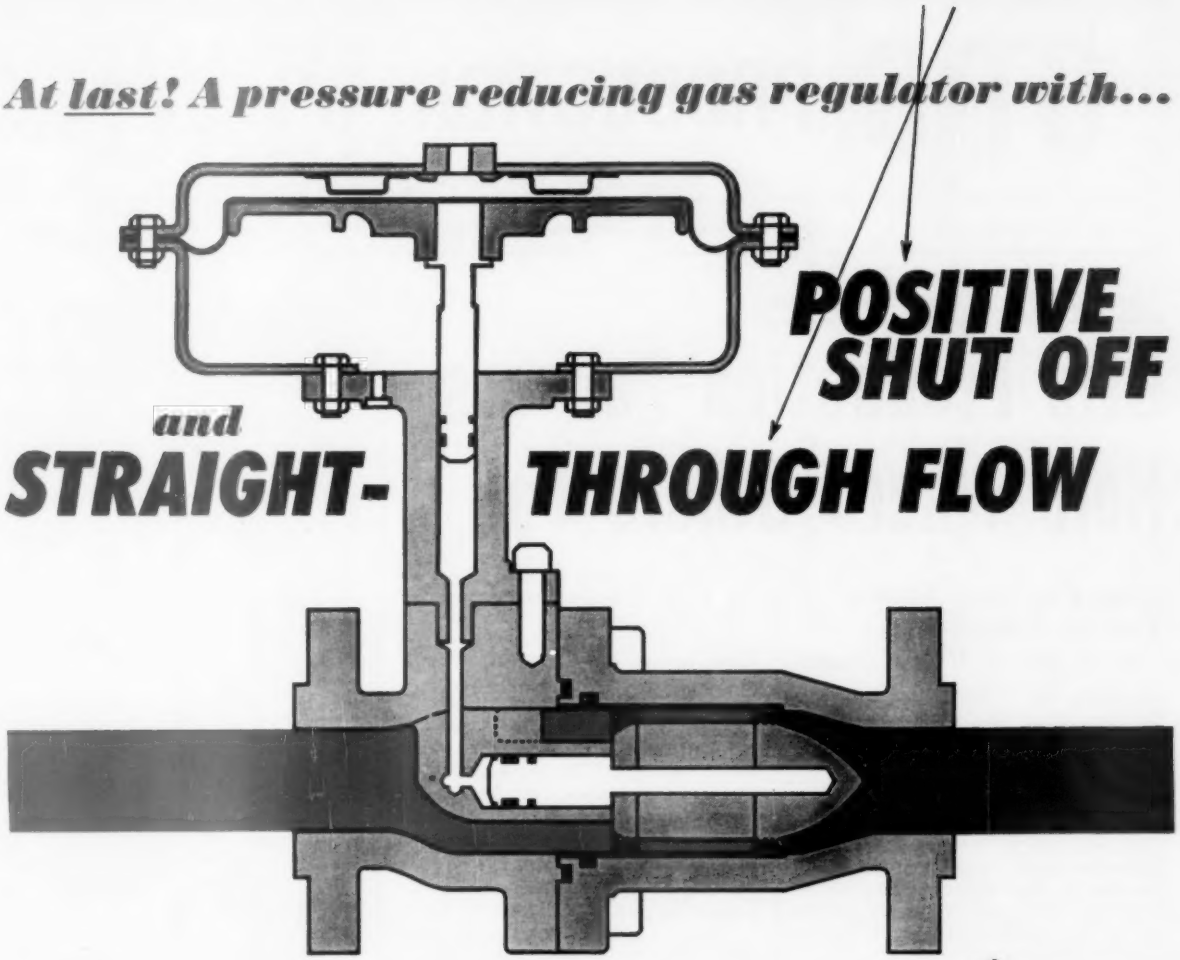
New 8″ Pump—Of different design than the rest of the line, the new 8″ Worthite pump has a twin volute liquid end. A water jacket which serves to either heat or cool the stuffing box area is an integral part of the stuffing box head. The pump can be disassembled from the rear without disturbing the volute, suction head or piping. Separate supports for frame and liquid end facilitate the disassembly.

For the name of your nearest Worthington distributor consult the Yellow Pages. Or write to Worthington Corporation, Section 20-13, Harrison, New Jersey.

*Worthite is a registered tradename for a high nickel, high chromium, molybdenum alloy steel. This "super" stainless steel is available only from Worthington.

WORTHINGTON

At last! A pressure reducing gas regulator with...



POSITIVE SHUT OFF

and

STRAIGHT-THROUGH FLOW

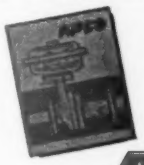
*The NEW Jet Stream Regulator**

Now you can stop high-speed gas turbulence, sound vibration, and leakage in your pressure regulators. The Jet Stream Regulator gives you straight-through laminar flow, positive shutoff, and no mechanical friction. Jet Stream's laminar flow stops the jetting of high speed gas and transient particles. This smooth straight-through flow also reduces sound vibration. Jet Stream's hydraulically actuated slave piston regulates flows with extremely fine control... from full flow to bubble-tight shutoff in three seconds. For efficiency and safety in your pressure reducing gas regulators... *use a Jet Stream Regulator!*

* *manufactured under the Welker Patent*

THE JET STREAM REGULATOR IS MADE IN THREE MODELS

• FLANGED • THREADED • INSERT



Write for the Jet Stream Catalog. A catalog giving complete specifications on the Jet Stream Regulator is available upon request.

APCO DIVISION OF TEXTRON INC.

engineering • design • development • manufacturing

OTIS PRODUCTION NEWS

Volume I, Number 1 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

Special Report from West Texas

Otis Production Packers Hold Where Others Fail

High Pressure, Strain, Tubing Vibration in Gas-Injection Wells Cause Bodies of Competitive Packers to Part

MIDLAND — Type WA Otis Production Packers have proved to be the solution to a serious problem encountered by a West Texas operator on a secondary recovery project. The problem was to find a packer that would stand the stress and vibration of the tubing in a number of high-pressure gas-injection wells.

The wells involved were being used to inject gas into the Devonian at approximately 12,500 feet. Injection rate was 2½ M.C.F.D. at 7,500 P.S.I. Due to vibration created by this high rate of injection, the tubing was set in tension with a minimum of 25,000 pounds' strain. These conditions apparently proved too strenuous for the packers used in the initial completion for they disintegrated shortly after the wells were put into operation.

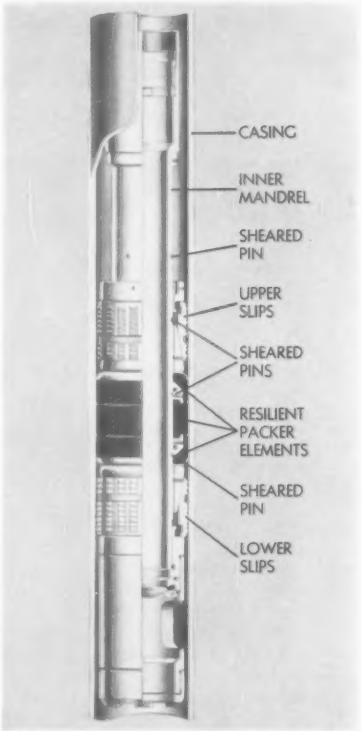
In analyzing this producer's problem, Otis packer specialists from the Odessa office felt confident the Type WA Otis Production Packer would stay in the hole in spite of the adverse working conditions because of the packer's "floating mandrel" design.

See diagram this page

This feature, unique among permanent-type retainer packers, is designed to prevent problems such as this which result when a packer's inner mandrel is permanently attached to the slips or packer body.

Unlike the packers originally used in these wells, the inner mandrel of the Type WA Otis Packer is not pinned to either the upper or lower slips, or the rubber element assembly, once the packer has been set. The mandrel is free to travel up or down within the outer packer body approximately 8 inches before being confined by a shoulder at either end, and is sealed off and held in position by O-rings and pressure from the compressed rubber packer elements. In this way, vibration or movement of the tubing string when transmitted to the packer mandrel is partially absorbed by the rubber packer elements first, and not directly transmitted to the slips or the outer packer body.

As a result, Type WA Otis Production Packers have replaced the packers originally used in these injection wells and the operator reports all have proved satisfactory. Several additional wells are to be drilled for this project and Type WA Packers have been specified for each.



When setting the Type WA Otis Production Packer, all pins holding the slips and resilient packer elements in the running position are sheared and the mandrel is free to float.

© 1960 O.E.C.

Drilling and Producing Division Heralds Otis' Entry Into Packer Field As 'Good News'

DALLAS — The news that Otis has acquired a new line of field-proven production packers and bridge plugs, and is now offering a "packaged" well completion service, has been well received by the drilling and producing division of the petroleum industry.

For the last 25 years, producing companies and packer manufacturers both have looked to Otis for guidance when engineering difficult well completions. Now, with its own line of packers, Otis will provide the industry a "packaged" well completion service to include both engineering and all sub-surface equipment.

The present line of Otis packers includes a series of Type WA Wire Line Set Drillable Retainer Packers which can be set on any wire line pressure setting tool; three tubing or drill pipe set packers which carry the designations Type TA, TB, and TE; a Type RA Retrievable Packer designed to be set in tension or com-

(See "Good News," Page 2, Col. 2)

Better Production Tools Through Research

Otis-Engineered Dual-Completion Saves Tubing Job 30 Days Following Initial Completion

THOMPSON CREEK FIELD, MISS. — A well, dually-completed in this western Mississippi field in November, 1959, produced approximately 200 B.O.P.D. from each zone immediately following completion, however both zones had to be put on pump in less than thirty days due to a decrease in bottom-hole pressure. The well completion, engineered by Otis specialists in that area, was designed to permit the operator to flow this well as long as economically feasible, then put both zones on pump without pulling tubing.

The well was completed with two packers, a dual and a single, a Type S Otis Landing Nipple and a Type A Otis Sliding Side-Door between the two packers for plugging and circulating purposes, and two Type S Otis Landing Nipples above the top packer in each string.

See schematic diagram — right

The conversion of this well to artificial lift was accomplished by landing Type S Otis Pump Locators and Hold-Downs in the top S nipple of each string and installing the pumps. As the zones deplete, the pump locators and hold-downs may be reset in the lower nipple of each string simply by pulling the pumps, retrieving the locators and hold-downs, changing the selective keys on the locators, and re-running the tools to the lower nipple. By using Type S Otis Landing Nipples instead of regular A.P.I. pump seating nipples, the tubing remains full-opening to permit running through-tubing perforating guns, bottom-hole pressure bombs, and other wire line service tools. Also, plug chokes and other Otis sub-surface flow control equipment may be set in any of the S nipples should it become necessary.

Good News

(Continued from Page 1)

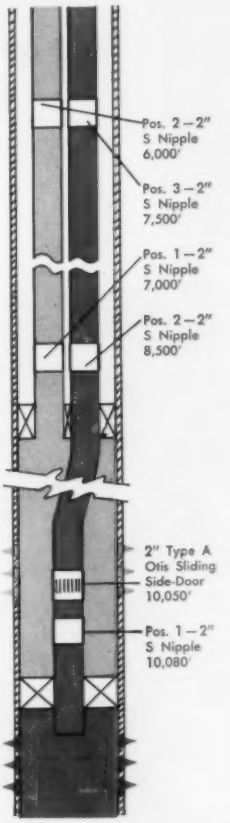
pression without modification; the Type HS Retrievable Isolation Packer which is set hydraulically, and two retrievable collet-type packers — one for slim-hole work and the other a regular casing collet-type packer.

A stepped-up research and development program is expected to produce several new types of packers in the immediate future to further round out the line of packers Otis already offers.

As part of the company's expansion program into the packer and bridge plug field, highly skilled packer specialists have been added to the staff of each Otis division. These men, working with other Otis well completion experts, form a team that operators can look to for a "packaged" well completion . . . as a single supply source for *all* necessary sub-surface completion equipment — from the wellhead to the plug on bottom.

Tool and Service Information

For additional information on any of the equipment reported in this issue of the Otis Production News, contact your nearest Otis office or write Otis Engineering Corporation, Dept. 1-P, Box 35206, Dallas 35, Texas. You'll find your Otis specialist ready to help you — anxious to serve you.



OTIS

Engineering OTIS Corporation

General Offices:

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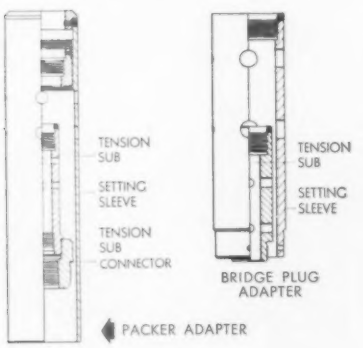


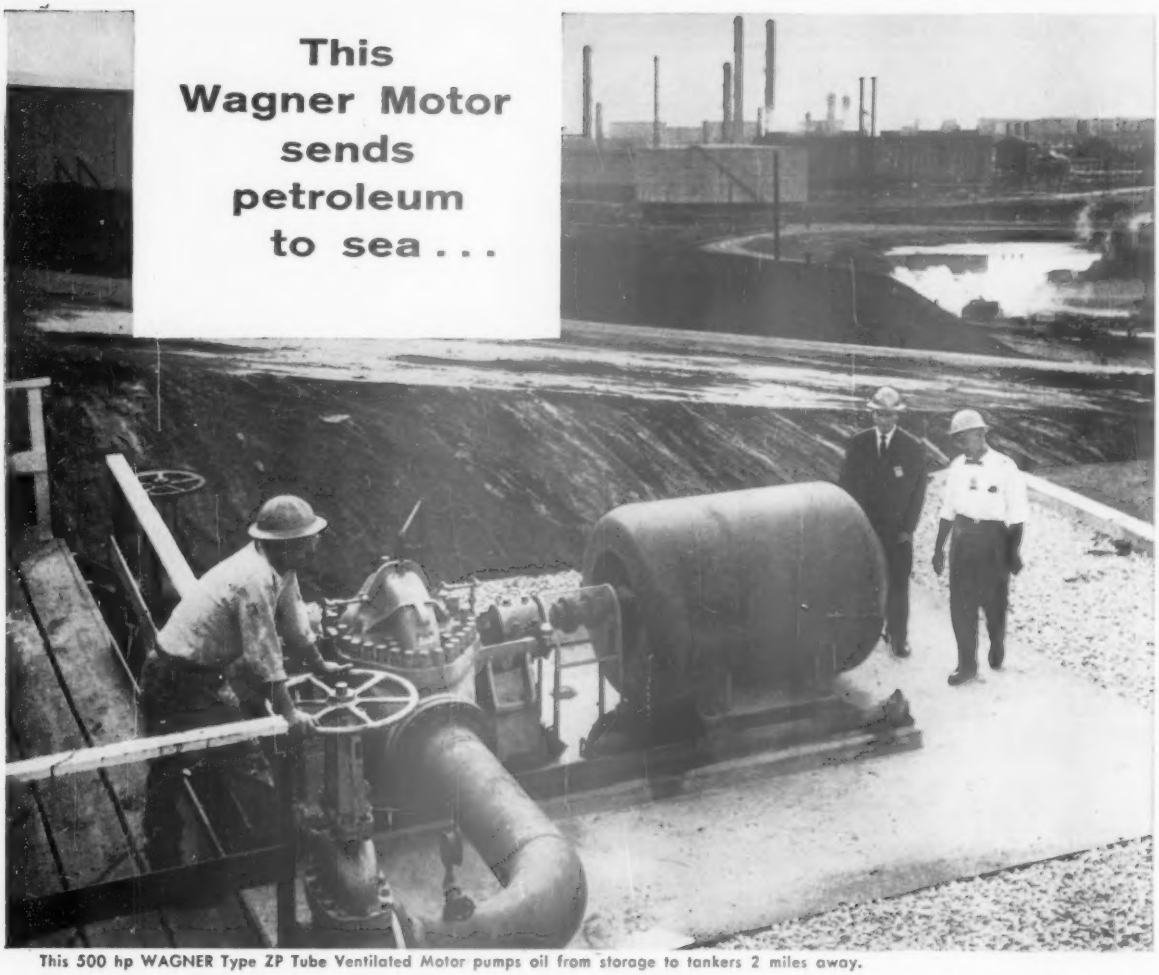
New Otis Packer and Bridge Plug Pressure Setting Tool Adapter Kits

Special pressure setting tool adapter kits have been developed to permit Type WA Otis Production Packers and Otis Wire Line Bridge Plugs to be set on the No. 20 pressure setting tool. Both of the adapter kits are extremely simple in design and can be easily made up with the setting tool.

The packer adapter kit consists of a tension sub, setting sleeve, and tension sub connector which is made up on top of the WA packer on the rig floor. The adapter for the bridge plug consists of only two sub-assemblies, a tension sub and a setting sleeve.

Both kits have been extensively tested in the laboratory and in the field, and neither has failed to operate as designed.

This Wagner Motor sends petroleum to sea . . .



This 500 hp WAGNER Type ZP Tube Ventilated Motor pumps oil from storage to tankers 2 miles away.

Big job, moving petroleum products to market. Standard Oil of California does it well . . . helped, at its El Segundo Refinery, by this 500 horsepower Wagner Tube Ventilated Motor. This explosion-proof motor's job: provide the power to pump crude oil from storage tanks down to the sea—and waiting tankers—two miles away.

Starting oil on a bon voyage is just one of many heavy-duty jobs performed by Wagner Tube Ventilated Motors. They also power big fans, blowers . . . any heavy-duty application that must be operated for long periods of time without a shut down.

These motors have fabricated steel frames that contain a series of tubes (as shown in photo below) through which cooling air is forced by an external blower. Internal blowers, one at each end of the rotor, circulate the warm air inside the motor through ducts in the rotor and stator and around cooling tubes. This effective cooling system holds the operating temperature of the motor within specified limits to lengthen motor life.

Whatever your motor requirements—large or small, for plant or product—Wagner can supply a standard motor or build a special motor to fit your needs. More than 65 years of constant research and development in electric motor design have made Wagner a name you can depend on. Call your nearby Wagner Sales Engineer for an analysis of your next motor application. There are Wagner branches in 32 principal cities.

WM60-11

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

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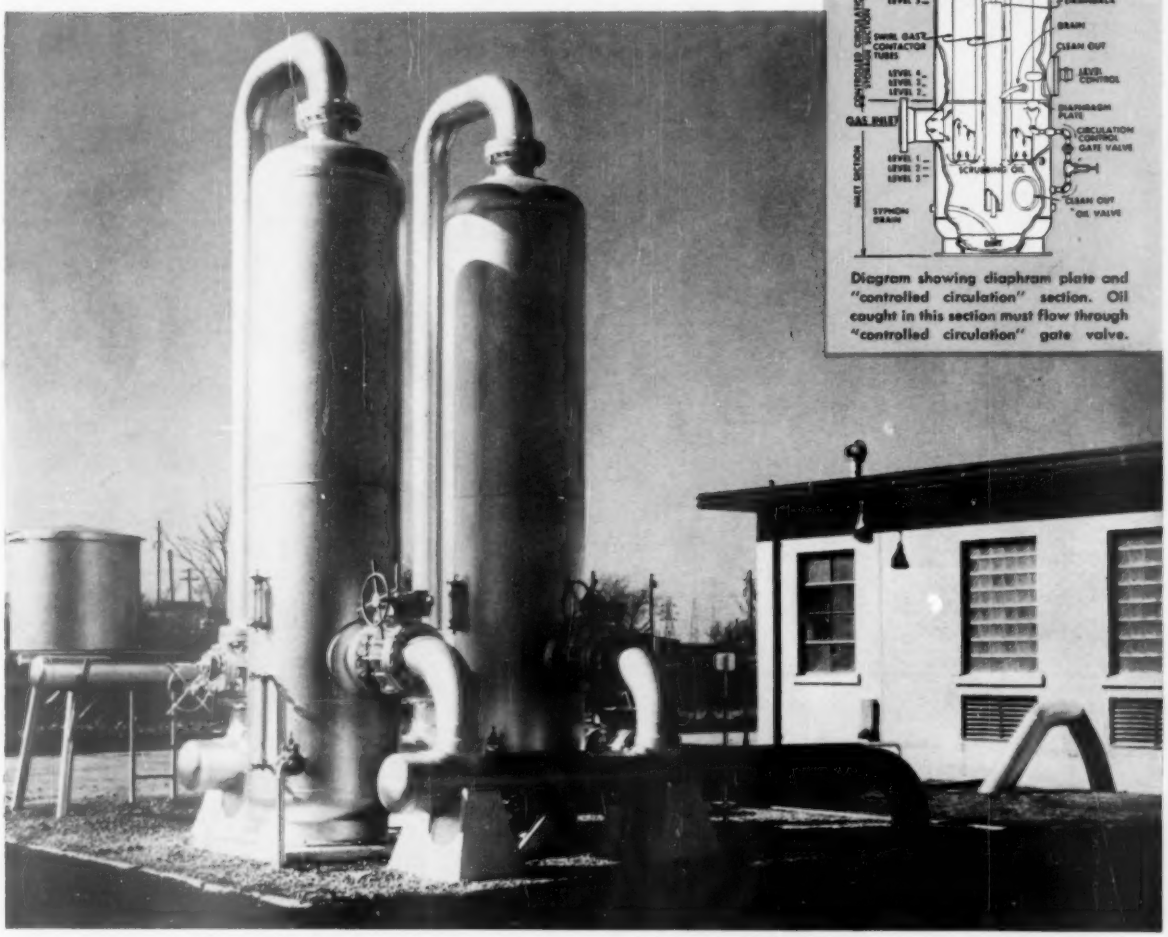
SERVING 2 GREAT GROWTH INDUSTRIES—*ELECTRICAL • AUTOMOTIVE*

New Peerless Gas Cleaner development provides cleaner gas at less cost



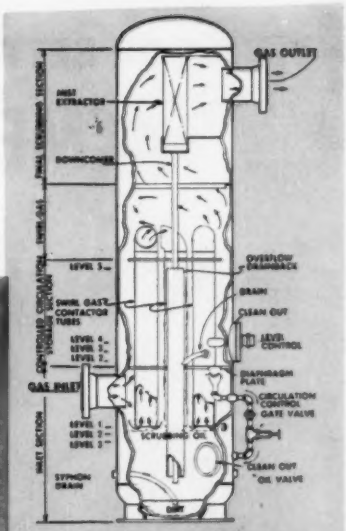


Diagram showing diaphram plate and "controlled circulation" section. Oil caught in this section must flow through "controlled circulation" gate valve.

More efficient liquid and dust removal is provided with Peerless "Controlled Circulation" Vertical Swirl-Gas Cleaner

With given gate valve setting, circulation of scrubbing liquid varies within narrow range even with widely varying gas flows . . . thus greatly reducing scrubbing oil loss. Scrubber will remove small quantities of dry solids or separate large quantities of liquid equally well with no adjustments required. In addition there are higher gas capacities because of limited mist extractor loading, less entrainment at gas exit end of contractor tubes, and use of larger mist extractor.

For details, Write for Peerless Bulletin 6-193.

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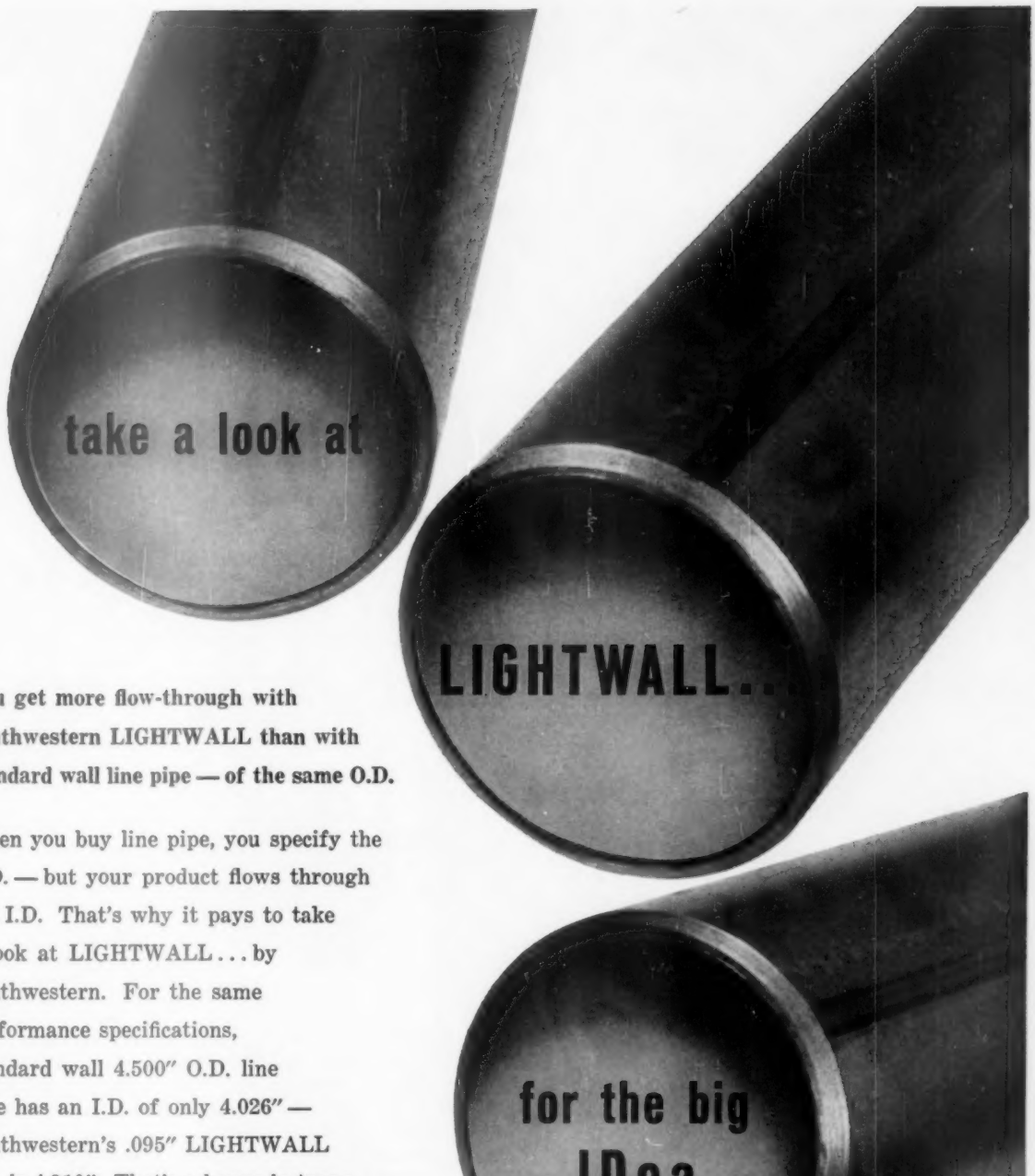

You get more flow-through with Southwestern LIGHTWALL than with standard wall line pipe — of the same O.D.

When you buy line pipe, you specify the O.D. — but your product flows through the I.D. That's why it pays to take a look at LIGHTWALL . . . by Southwestern. For the same performance specifications, standard wall 4.500″ O.D. line pipe has an I.D. of only 4.026″ — Southwestern's .095″ LIGHTWALL I.D. is 4.310″. That's a bonus in transmission capacity of almost $\frac{3}{10}$ of an inch!

You can depend on our prompt, reliable deliveries . . . usually from warehouse inventories.

SOUTHWESTERN PIPE, INC.*

** Corporate name changed from Southern Sales & Transportation Co. May 1st, 1959*

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SPIPE

LICENSED BY THE AMERICAN PETROLEUM INSTITUTE

A special message to everyone born between 1938 and 1942

Hey, there! You with the freshly-starched diploma in your hand! Discouraged with your first hard look at this topsy-turvy world? Think someone chopped out the rungs in the ladder of success? Think opportunity is dead?

Don't you believe it! Today, opportunity under America's free enterprise system is more alive than ever! Within the next few years, you'll see space travel programs accelerate and inspire now unheard-of products. You'll see standards of living go up. You'll see exciting new jobs created out of nowhere.

Take our own business, for example. Oil. In the next few years, we *know* Standard Oil will create a cornucopia of new products and new processes. And that means opportunity! But it takes time, work, and study to turn opportunity into advancement. People who are willing to put forth the extra effort to prepare for greater responsibility will find opportunity awaiting them.

Is opportunity dead? Whenever we hear that question, we think of the thousands of people who won promotions last year at Standard Oil and the fact that most of our officers and directors since this company started have come up through the ranks. No Standard job is too big a target for any employee...if he listens for opportunity's knock and is ready for it when it comes.

Opportunity dead? Not by a long shot!

WHAT MAKES A COMPANY A GOOD CITIZEN? One way to judge is by a company's economic effect on a community. Is it growing? Is it progressive? Will it provide opportunities for advancement? For the five years from 1954 to 1959, Standard spent $1.4 billion on new facilities. Expenditures like these help to create new opportunities.

STANDARD OIL COMPANY
(INDIANA)

STANDARD

THE SIGN OF PROGRESS...
THROUGH RESEARCH

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ANOTHER FIRST

9 NEW FLANGED END FORGED STEEL

GENERAL PURPOSE

Gate, Globe and Check

VALVES

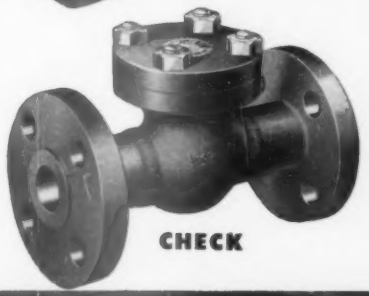
HARD FACED SEATS

150, 300 and 600 lb. STANDARD

featuring

GATE

GLOBE



CHECK

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GENERAL GP PURPOSE

Vogt FOR BETTER VALVES

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FORGED STEEL

VALVES

DODGE TAKES OVER
where roads leave off!

Dodge Power-Wagons with four-wheel drive make tracks where ordinary trucks can't tread. They power their way across soggy fields, up roadless hills . . . through sand, snow or mud. Where roads aren't, these huskies make their own . . . to your oil rig, pipeline, exploration site. Where roads *are*, just disengage front-drive for smooth travel.

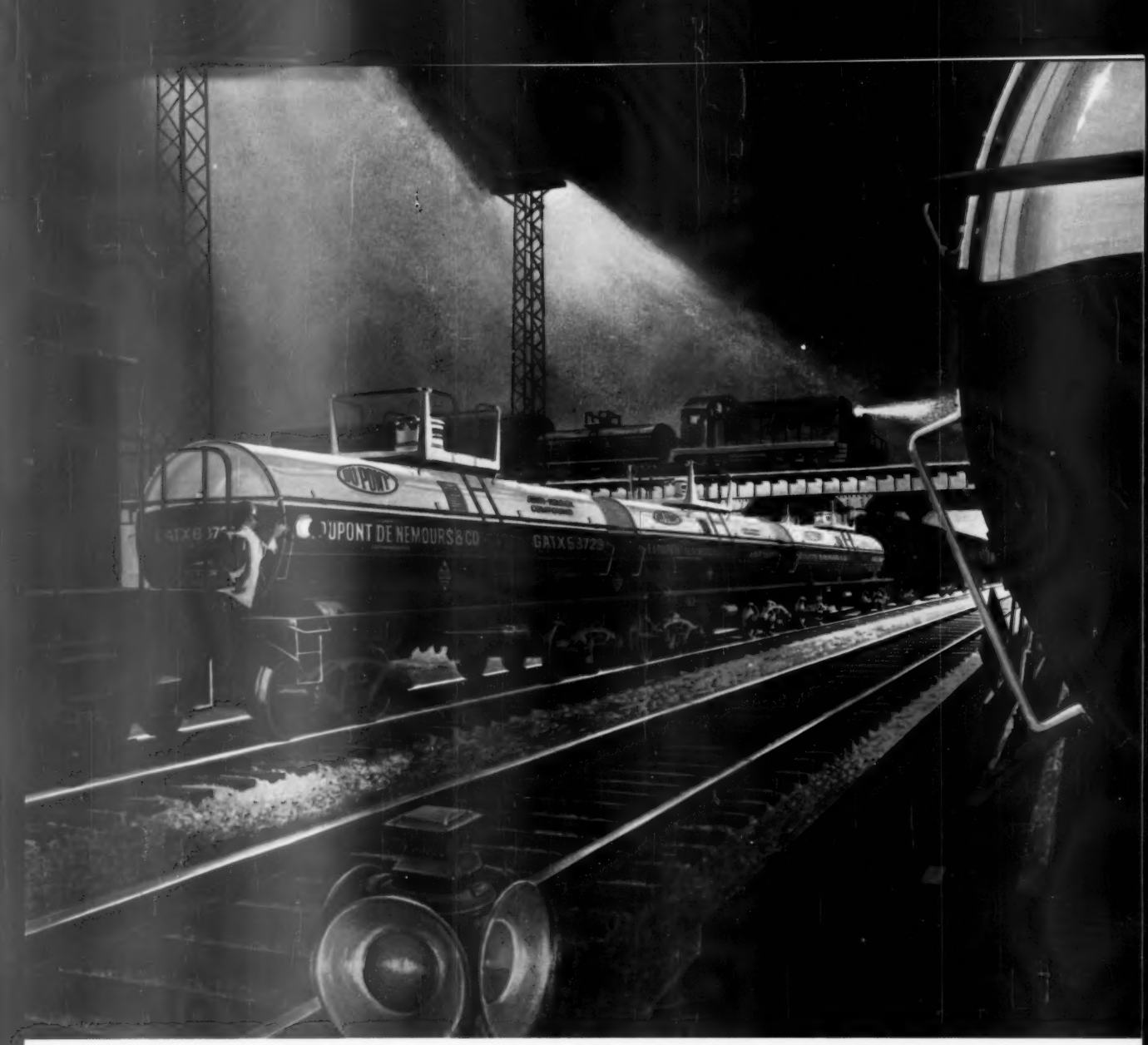
Your pick of sturdy pick-ups, stakes, the station-wagon-type Town Wagon and cab and chassis for special bodies. G.V.W.'s from 5,100 to 20,000 lbs. Pick your power, too . . . from 113 to 202 horsepower in thrifty Dodge Sixes and V-8's.

If roads are a rarity where you operate, you'd best make tracks to your nearest Dodge dealer. He can give you fast delivery on the new Dodge Power-Wagon of your choice. Or on *any* of the 140 models in this year's Dodge truck line. On the road or off, you can

DEPEND ON DODGE TRUCKS
TO SAVE YOU MONEY IN

Hefty Two-Speed Transfer Case teams up with rugged Dodge 3- and 4-speed transmissions and powerful engines to produce that *special* kind of off-or-on-road "go" found only in '60 Dodge Power-Wagons. Power take-off available.

A PRODUCT OF CHRYSLER CORPORATION



Convenient 'round-the-clock delivery service for Du Pont tetraethyl lead customers

No matter what time of day or night your order for a tank car shipment of tetraethyl lead reaches us, there is a car already loaded and waiting on a rail siding not far from your refinery.

We call this 'round-the-clock delivery system our "warehouse on wheels." It's a ready-made assist for your emergency TEL needs, enabling you to meet additional production requirements on short notice.

And it also acts as a backstop for our regularly scheduled TEL delivery program—minimizing the danger of a shutdown due to a delivery delay caused by unforeseen circumstances.

In addition to our three plant locations there are 25 special rail sidings located near the major refining areas to take care of all possible refinery needs.

Assurance of fast and reliable delivery service, either for TEL or other petroleum additives, is just one of the advantages of doing business with Du Pont.

For the many other services available, contact your Du Pont representative or write to E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

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It provides facilities for sending and receiving on message paper or sprocket-fed business forms. In addition, there is a choice of four different tape reader and four different tape punch components—for preparing punched tape and for sending and receiving with tape.

The flexibility of the set is further broadened by a built-in control unit, the "stunt box," which may be equipped for a wide variety of extra features and switching duties—eliminating the need for external apparatus often required for such functions.

The ASR set is a compact, efficient tool to speed communications and cut costly paperwork. Why not investigate what it can do for you?

Typing Tape Punch

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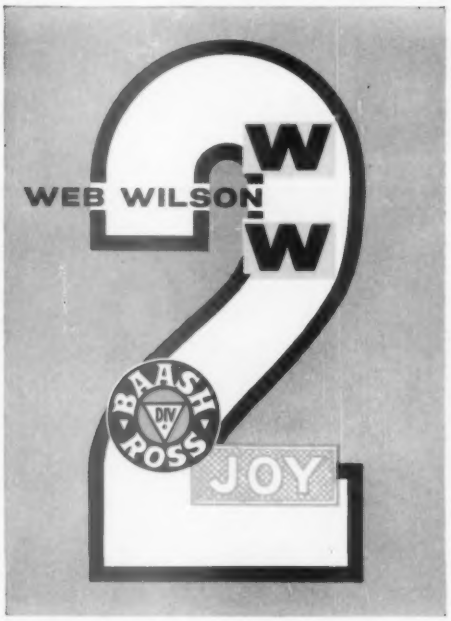
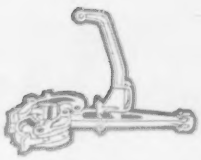
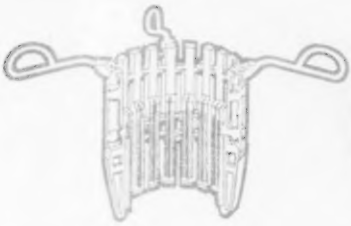




Great Lines Become 1 Better



Web Wilson Now A Part of The Baash-Ross Division of Joy Manufacturing Company

Joined with the well known line of Baash-Ross products is the Web Wilson line of hooks, elevators and links, tongs, and other products, for one better line of equipment to serve the drilling industry.

With even better service, quicker delivery, and one manufacturer responsibility, customers using Baash-Ross—Web Wilson products will realize more fully the advantages of this equipment.

Specify with confidence Baash-Ross—Web Wilson Tools . . . your assurance of quality and continuing service.

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It can't rust or rot—is free from electrolytic action—impervious to water and the usual soil elements—highly resistant to most chemicals. Pipe made of KRALASTIC®, the original ABS rubber-resin, never needs coating, lining or anode protection.

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- It can be snaked through many existing lines—eliminates much time- and money-wasting ditching.
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- It can be quickly and easily solvent welded—with just the stroke of a brush. Or it may be threaded and used with threaded fittings.
- KRALASTIC has outstanding impact strength—even at arctic temperatures.

In short, KRALASTIC is a noncorroding pipe material with a combination of properties no other pipe material can match.

Proof of KRALASTIC pipe performance? More than 9,000 miles of KRALASTIC pipe have been specified, installed and are now in trouble-free service carrying potable water, brine, gas, a wide variety of chemicals and even electrical wire and cable. KRALASTIC pipe has been approved by the National Sanitation Foundation and is already accepted in many local plumbing codes.

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*Estimate of the National Bureau of Standards

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They Say—

Wright's wrong

Dear Sir:

We draw your attention to the incorrect spelling of the name of one of our authors—the name is W. N. N. Knight, not Wright as shown in the article "What BP Learned About Middle East Crudes for Cat Cracker Feed Stocks" (OGJ, Feb. 29, p. 70).

G. N. Griffiths
BP (North America) Ltd.

Two good reasons!

Dear Sir:

In The Oil and Gas Journal story on Sabine Lake (Mar. 7, p. 147), I must beg to point out an error in the map. The California Co. location is incorrect for two reasons:

1. It's on the Texas side of the lake as you have it, and that's not right.
2. California Co. does not operate in Texas.

The Bauman location is not correct with respect to the Port Arthur field, but that's a minor error. The California Co. location at least should be on the Louisiana side of the lake.

Geneos Pete Cokinos
Beaumont, Tex.

Too many acres

Dear Sir:

In the February 22 issue of The Oil and Gas Journal, page 83, there was a table showing the exploitation holdings of the Venezuelan concession owners. For Venezuelan Atlantic, an incorrect figure of 3,194,735 acres was given for our holdings as of December 31, 1959.

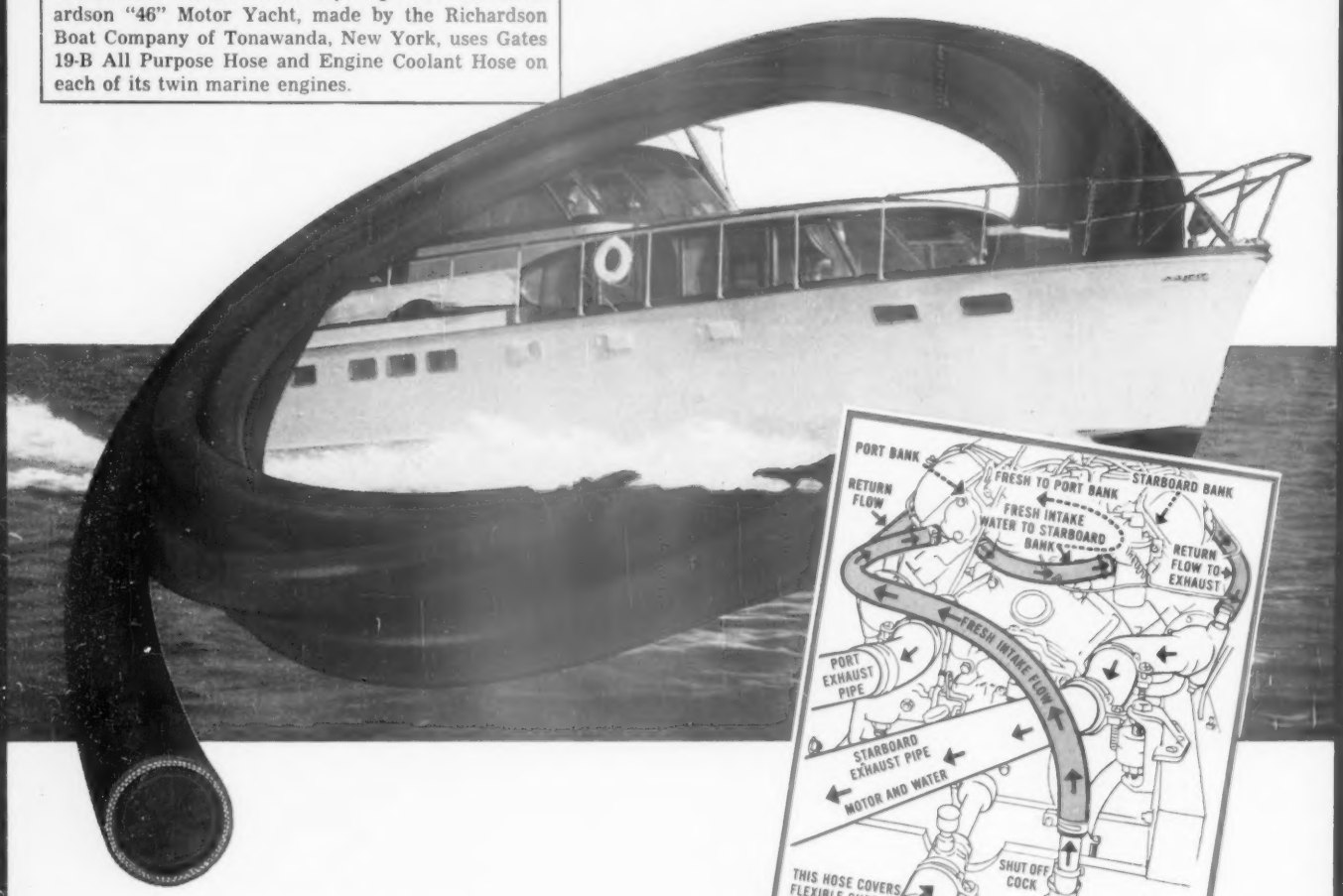
Although we do not have official government figures available here in Philadelphia, our nearest calculations indicate that Atlantic's exploitation concession at the year end amounted to about 700,000 acres.

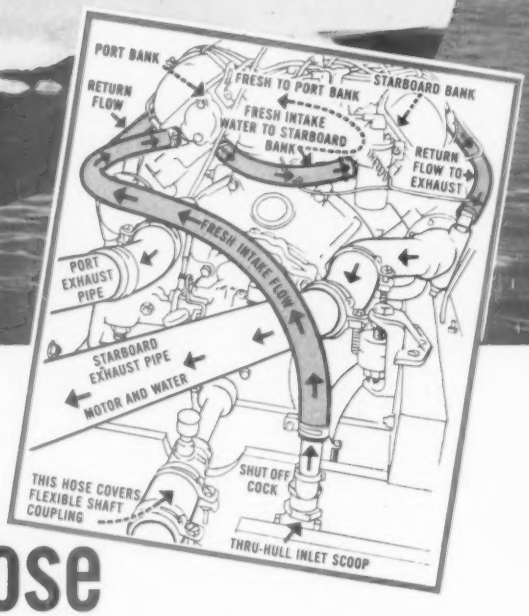
For your information we also note that the total of 13,716,436 acres for all of the companies is not a correct addition of all of the figures listed.

T. C. Veale,
Assistant Director
Public Relations
Atlantic Refining Co.

(Editor's note: Our pencil slipped in converting hectares to acres. Venezuelan Atlantic should have been

You find Gates Hose where anything flows. The Richardson "46" Motor Yacht, made by the Richardson Boat Company of Tonawanda, New York, uses Gates 19-B All Purpose Hose and Engine Coolant Hose on each of its twin marine engines.





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credited with 794,732 acres. The total for all companies should have been 13,717,435.)

IPAA sorts causes, effects

Dear Sir:

Thanks very much for your editorial in the February 29 Journal ("What's the Matter With the Oil Business?"). It was indeed a most interesting editorial.

We cannot, of course, help but think that your conclusions carry some real weight, but certainly what we wish to do is to sort out what are causes and what are effects.

Then, if what we are looking at happens to be an effect rather than a cause, we want to run down the culprit Cause to the end that this "body" who is wanting somebody else to do something that will let him carry on his business in the same old way, will be forced to realize it can't be done in the same old way.

Changes are inevitable. Immediately following the close of the war in late '45 we went after changes in a mad rush, and, of course, many of us are reluctant to reverse the process when we over-did so many things between the years '46 and '51 and then again got our second wind during Korea and continued the over-doing.

Alvin C. Hope
President
Independent Petroleum
Association of America

Isomerization prospects

Dear Sir:

The report of my talk to the American Chemical Society petroleum symposium in the February 29 issue (p. 54) appears to give an impression I did not intend. I think this was the result of paring the quotes too closely.

Speaking on isomerization I said, "Normal and slightly branched pentanes and hexanes are susceptible to octane improvement by isomerization processes. These processes can also be grouped into two competing types. The first and oldest uses the Friedel-Crafts catalyst in a liquid phase or in solid supported form. The other group of processes uses solid catalysts containing metals usually with hydrogenating activity.

"Here is a typical situation which trends do not help to resolve. To the extent that isomerization contributes octane number, all less costly octane numbers from other processes are being exploited first. Advanced engines distinguish to some extent between the octane numbers and other quality features supplied by these highly branched, light hydrocarbons. But this

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• *in hydraulic and pneumatic mechanisms*
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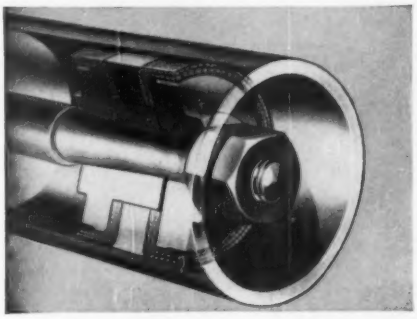

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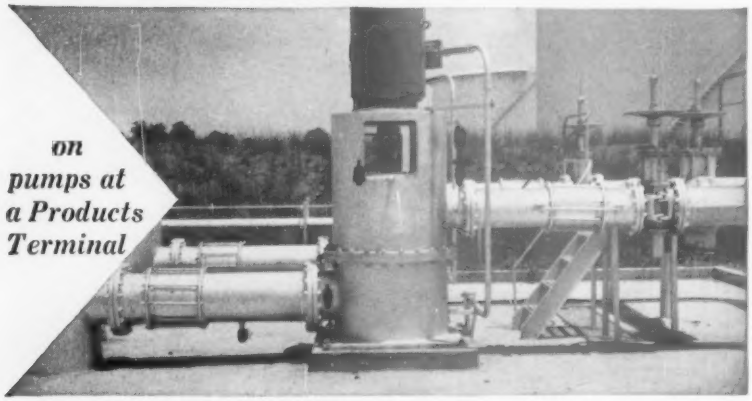
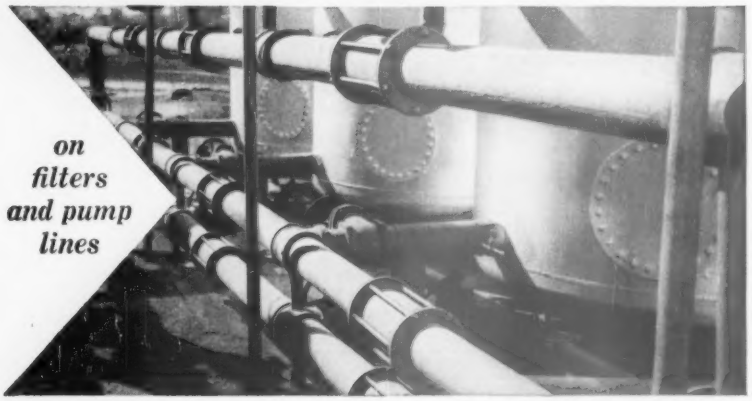


easy, bottle-tight...



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distinction is not yet of such degree that the industry senses a feature for aggressive selling."

The complete quote spells out somewhat more conservative prospects for isomerization, at least in the near future. Major application depends on new consumer benefits worth the cost.

W. J. Borns
Director of
Research Planning
Socony Mobil Oil Co., Inc.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

MARCH

30-Apr. 1 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita.

APRIL

3-5 Society of Exploration Geophysicists, annual midwestern regional meeting, Washington-Youree and Captain Shreve hotels, Shreveport, La.

3-8 Engineers Joint Council, sixth nuclear congress, New York.

4-6 American Institute of Electrical Engineers, southwest district meeting, Shamrock-Hilton Hotel, Houston.

4-7 Oil Heat Institute of America, annual convention, Park-Sheraton Hotel, New York.

4-7 National oil heat and air-conditioning exposition, Coliseum, New York.

4-8 Society of Automotive Engineers, national aeronautic meeting, Commodore Hotel, New York.

5 Petroleum Equipment Suppliers Association, southern mid-continent district membership meeting, Statler Hilton Hotel, Dallas.

5-6 University of Kansas, eighth annual gas compressor institute, National Guard Armory, Liberal, Kans.

5-7 Instrument Society of America, national chemical and petroleum instrumentation symposium, Rochester, N. Y.

7-8 Rocky Mountain Oil and Gas Association, midyear meeting, Newhouse Hotel, Salt Lake City.

8 Chemical Institute of Canada, rubber chemistry division, annual meeting, Kitchener, Ont.

12-14 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, conference and exhibition, Municipal Auditorium, Kansas City.

15-16 Society of Economic Paleontologists and Mineralogists, Permian Basin section, annual meeting, technical session and field trip, Windsor Hotel, Abilene, Tex.

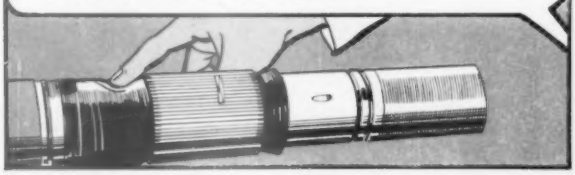
15-16 Society of Economic Paleontologists and Mineralogists, Pacific section, annual spring field trip, Panoche Hills, San Joaquin Valley, California, and evening meeting, The Hacienda, Fresno, Calif.

19-21 University of Oklahoma, College of Engineering, southwestern gas meas-

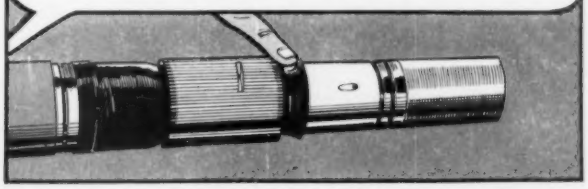
HERE'S A REPORT ON THE DURABILITY OF THE RUBBER-TYPE ELEMENTS USED IN OUR TYPE OF GAS LIFT VALVES — AND HOW THE DESIGN PRINCIPLE SAVED A SOUTH TEXAS WELL OWNER THE COST OF A CONVERSION WORKOVER.

The valves covered by this report have been in the well for 5 years now—and have given perfect service. What's more, they saved the operator the cost of a workover just three months following installation, when the well had to be converted from continuous to intermittent lift. The well has been produced intermittently since that time and the well owner is pleased with the operation of the valves.

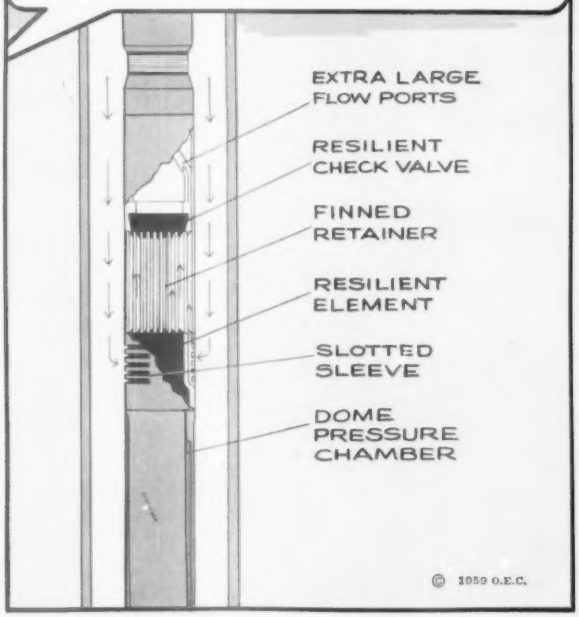
Here, let me show you the many advantages of the resilient elements in our valves. First, because this main element is resilient, it resists erosion from the system gas. Second, the flow area across the element is the largest flow area of the valve, which not only helps to reduce any cutting action from the system gas but minimizes the movement required to admit gas from the annulus during operation. These features are designed to prevent fatigue.



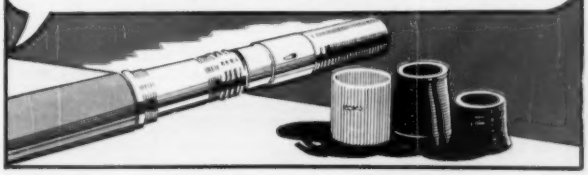
The same principles apply to the check valve here. It compresses just slightly as gas passes over it, then —when necessary to check back pressure from the tubing—it acts to form a bubble-tight seal against the finned retainer and inside wall of the valve. And the rubber-to-metal seal principle of both resilient elements eliminates the excessive wear normally associated with metal-to-metal, stem-and-seat type valves.



I'll show you how we bond the main valve element to the valve mandrel assembly in a minute—but first let me show you this flow diagram of our Type C Gas Lift Valve. Pressure from the valve dome holds the main valve element closed across the slotted ports. When gas pressure in the annulus exceeds the set pressure of the valve, the main valve element opens. When the pressure from the annulus drops below the set pressure of the valve, the valve closes.



Now here's how we bond the main valve element to the valve mandrel assembly. First we serrate the sealing surfaces of the mandrel assembly to give it a superior bonding surface. Then we apply a special bonding cement, slip the rubber element into place, and bake the complete assembly for one hour at 375° F. This produces a pressure-tight seal at the element end of the dome chamber. As a result, our valves can be expected to maintain their set pressure indefinitely.



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urement short course, north campus, University of Oklahoma, Norman.

19-21 American Society of Lubrication Engineers, annual meeting and lubrication exhibit, Netherland Hilton Hotel, Cincinnati.

20 Chemical Institute of Canada, joint meeting, Quebec rubber and plastics group and Montreal section, Queen's Hotel, Montreal.

20-22 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone, Henning, and Townsend hotels, Casper, Wyo.

20-22 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

21-22 Oklahoma State University, technical conference on heat transfer, Stillwater, Okla.

21-22 Texas Technological College, seventh annual West Texas oil lifting short course, Lubbock, Tex.

24-26 Independent Petroleum Association of America, midyear meeting, Denver Hilton Hotel, Denver.

25 University of Oklahoma, fifth annual conference on automatic control in the petroleum and chemical industries, Norman, Okla.

25-26 American Society of Mechanical Engineers, maintenance and plant engineering conference, Chase-Park Plaza Hotel, St. Louis.

25-27 Southern Gas Association, convention, Buccaneer and Galvez hotels, Galveston.

25-28 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

25-29 American Welding Society, annual meeting and welding exposition, Los Angeles.

27-29 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

28-29 American Petroleum Institute, Division of Transportation, pipeline conference, Mayo Hotel, Tulsa.

28-29 Pacific Coast Gas Association, distribution conference, Benson Hotel, Portland.

28-May 1 Mississippi Geological Society and Society of Economic Paleontologists and Mineralogists, Gulf Coast section, field trip to coastal Mississippi and southwestern Alabama.

29-30 Mississippi Academy of Sciences, Inc., Millsaps College, Jackson, Miss.

30 Geological Society of America, Rocky Mountain section, Black Hills area field trip.

MAY

1-3 Texas Independent Producers and Royalty Owners Association, fourteenth annual membership meeting, Holiday Inn, Carlton and Blackstone Hotels, Tyler, Tex.

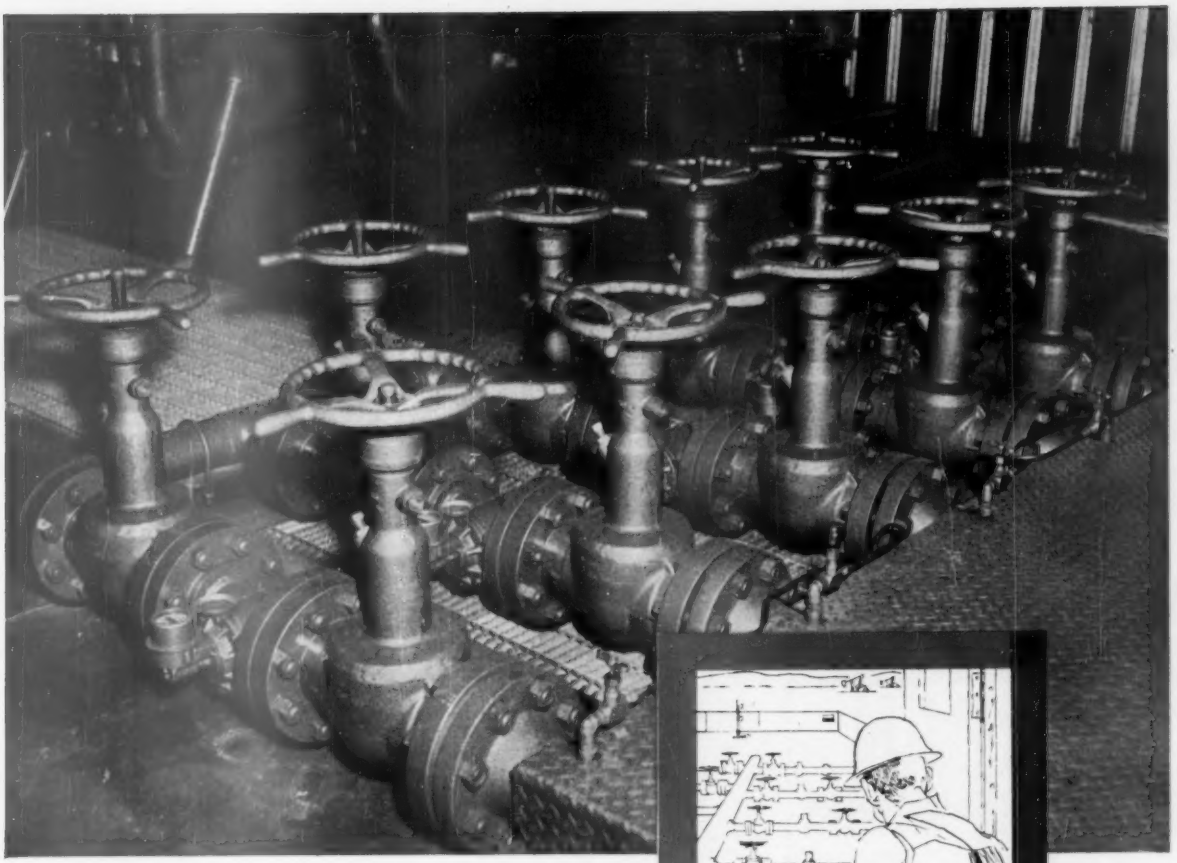
1-4 American Petroleum Institute, Division of Transportation, tanker conference, Seaview Country Club, Absecon, N. J.

2-3 Society of Petroleum Engineers of AIME, North Texas section, fourth biennial secondary recovery symposium, Wichita Falls, Tex.

5-6 American Institute of Mining, Metallurgical and Petroleum Engineers, annual joint meeting of Rocky Mountain petroleum sections, Calgary.

5-6 Canadian Institute of Mining and Metallurgy, annual technical meeting of petroleum and natural gas division, Palliser Hotel, Calgary.

9-12 American Petroleum Institute, Divi-



ORBIT VALVES

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Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

sion of Refining, midyear meeting, Statler and Sheraton-Cadillac hotels, Detroit.

9-12 Instrument Society of America, instrument-automation conference and exhibit, Civic Auditorium and Brooks Hall, San Francisco.

9-13 American Gas Association, distribution and transmission meeting, Jung and Roosevelt hotels, New Orleans.

11-12 University of Kansas, gas conditioning institute, National Guard Armory, Liberal, Kans.

11-14 Fluid Controls Institute, spring meeting, The Greenbrier, White Sulphur Springs, W. Va.

12-13 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

12-14 Kansas Independent Oil and Gas Association, annual meeting, Lassen Hotel, Wichita.

13-14 Southern Methodist University, School of Engineering, advanced technology seminar on heat transfer in electronics and direct conversion of heat to electricity, Dallas.

16-17 International Society of Professional Well Log Analysts, first annual meeting, Tulsa Hotel, Tulsa.

18-20 American Petroleum Institute, Division of Marketing, midyear meeting, Statler-Hilton Hotel, Cleveland.

22 Pennsylvania State University, short course in reservoir engineering, University Park, Pa. Term ends June 10.

22-26 Air Pollution Control Association, annual meeting, Netherland-Hilton Hotel, Cincinnati.

23-24 American Gas Association, production meeting, Roosevelt Hotel, New York City.

23-26 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Muehlebach Hotel, Kansas City.

24-26 American Right of Way Association, annual seminar, Shoreham Hotel, Washington.

25-27 Pacific Coast Gas Association, accident prevention and transmission conference, Hotel Utah, Salt Lake City.

25-28 American Association of Petroleum Geologists, western Canada regional meeting, Banff Springs Hotel, Banff, Alta.

26-27 Natural Gas and Petroleum Association of Canada, meeting, Niagara Falls, Ont.

JUNE

1-3 Texas College of Arts and Industries, fifteenth annual short course on gas technology, sponsored by Southern Gas Association, Kingsville, Tex.

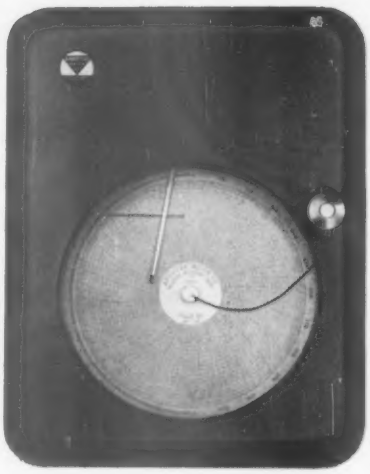
1-3 West Virginia University, fifth annual Appalachian underground corrosion short course, Morgantown, W. Va.

2 Pennsylvania Grade Crude Oil Association, annual meeting, Pennhills Club, Bradford, Pa.

2-3 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago.

9-11 Interstate Oil Compact Commission, midyear meeting, Sheraton-Cadillac Hotel, Detroit.



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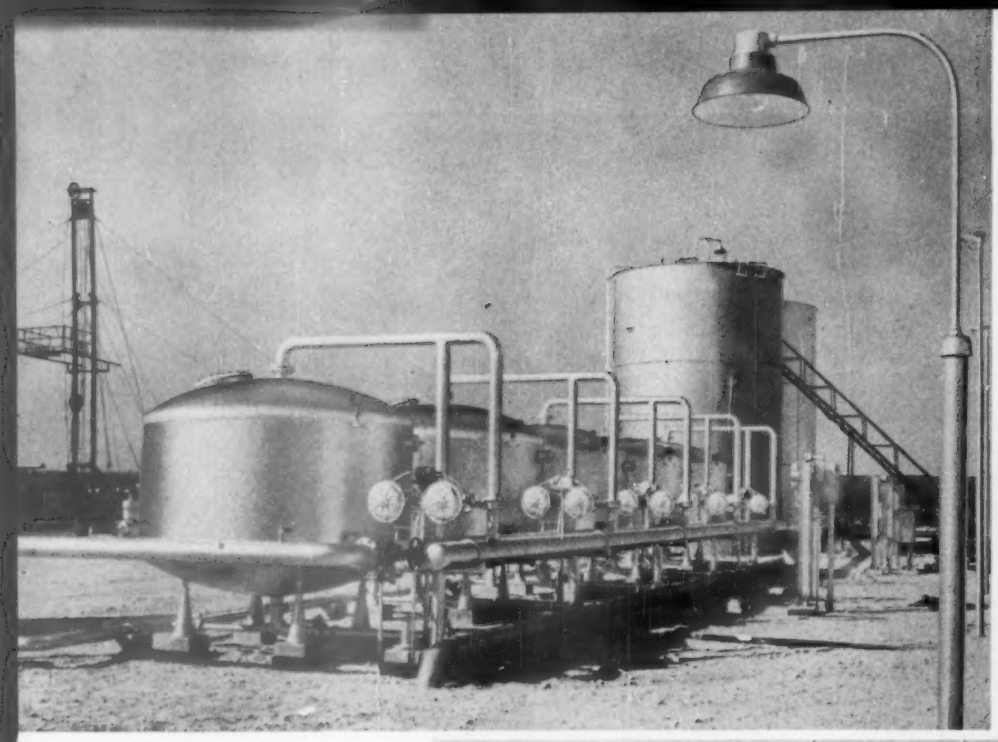

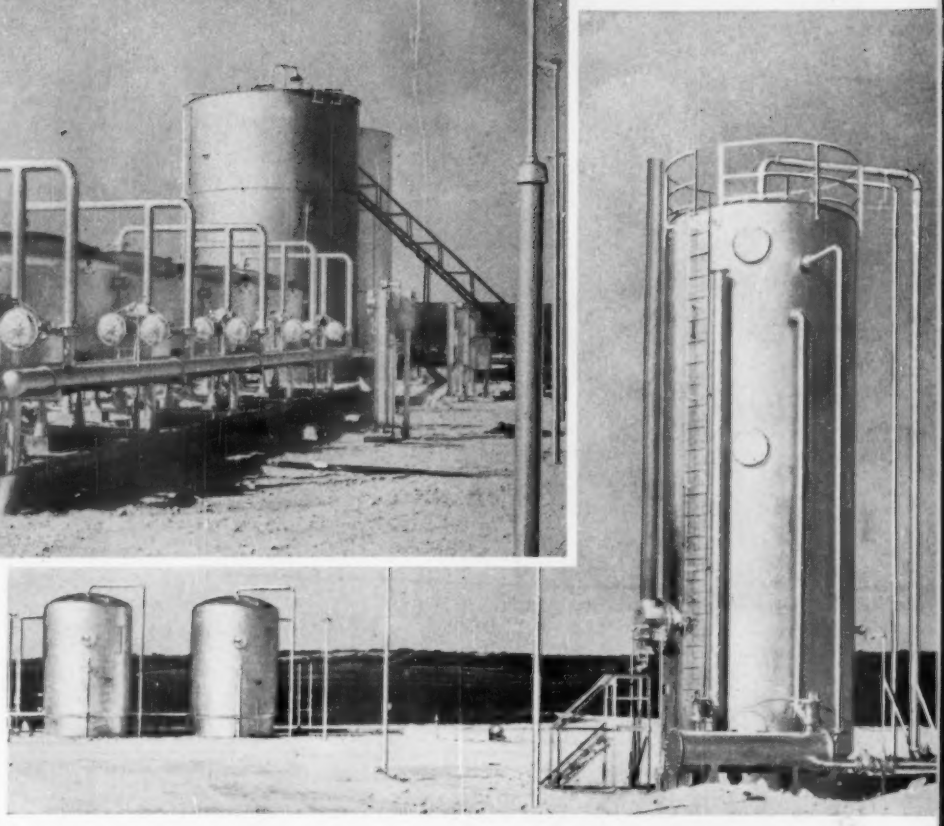

Automatic Waterflood System . . .

Utilizes BS&B AQUA-Kleener!® Filters, Oilfield Equipment and Controls

Down in Mid-Texas, there's a "young" waterflood just getting well started that operates on a completely *automatic* basis — with the aid of 5 BS&B AQUA-KLEENER Filters, 2 BS&B Free Water Knockouts, a BS&B Type S Treater, several BS&B Bolted Steel Tanks and numerous BS&B Controls. These include valve actuators, time clock controls, liquid level controls and pressure differential controls.

In this system, production water from the treater and the free water knockouts is combined with "source water" from 2 750-bbl. tanks (fed by 2 water wells), and is pumped through the filters to the injection pumps, and thence into several injection wells.

The 5 filters are controlled by a preset time clock on a cycle that keeps some of them on stream while others are on automatic backwash. The piping manifold on the filters and twin valves is so arranged that when the time clock closes the inlet valve, it opens the other valve starting the backwash cycle.

This installation is a good example of BS&B "Oilfield Automation" at work. Why not let your BS&B Man help you put your operations on an automated basis, too?

EFFICIENCY OVER 50 YEARS RELIABILITY
BS&B
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Whether it is a mud engineer's report or a driller's log, in case after case Baroid's new concept of mud marketing gives you better results. You may save in total drilling time, avoid a costly fishing job, or make substantial savings on mud material costs. In any case, you profit because Baroid has integrated and streamlined every step in the mud process, from original source to your drilling rig.

Simplified operating procedures are the order of the day in the oil industry. When an oil industry supplier, such as Baroid, controls all its services from mines, plants, laboratories, field engineering, well logging, stores and accounting, increased efficiency and savings result for you. Only through this method can product quality and complete service be maintained at the highest level in a competitive market.

Wherever you drill, Baroid has mud stocks nearby. Delivery is fast and accurate. You can secure all needed mud materials from a single source. Baroid's third of a century in the mud business gives you the greatest depth of experience and breadth of service. Baroid's unified operation helps you keep rigs on schedule and operating costs at a minimum.

You save drilling dollars with a Baroid mud program!

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BAROID DIVISION NATIONAL LEAD COMPANY

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6047

JOURNALLY SPEAKING

50 years ago

April 6, 1910

George C. Priestly, of Bartlesville, acting for E. S. Heller, San Francisco attorney, exercises purchase options on more than 20,000 acres of oil properties owned by nearly a dozen independent companies in northeastern Oklahoma's Cherokee and Osage nations. Deal involves daily production of 15,000 to 20,000 bbl., valued at more than $5,000,000. Mystery surrounds identity of real purchaser.

Gulf Pipe Line Co. moves into its own newly completed three-story office building at Beaumont, Tex. J. M. Guffey Petroleum Co., Gulf associate, also will office in the new building. Both companies have been in the Wiess Building for 6 years.

A disastrous fire sweeps Glenn Pool, south of Tulsa. Prairie Oil & Gas Co. loses five 1,600-bbl. and eight 250-bbl. tanks; Laurel Oil & Gas Co., one 250-bbl. and five 1,600-bbl. tanks, and two lease houses; Winona Oil Co., four drilling rigs and one 250-bbl. tank; Gypsy Oil Co., one rig, and one 250-bbl. tank.

25 years ago

April 4, 1935

Blowing in of largest wildcat oil well in Michigan's 10 years of oil history initiates new major play. Flowing out of control for nearly 24 hours, J. W. Leonard Drilling Co.'s Durbin test in Crystal Township, Montcalm County, is estimated good for 5,000 bbl. daily. It opens first production from Dundee formation in county. Total depth is 3,198 ft. Nearest production is three small, shallow Traverse wells, 11 miles distant. It is 65 miles east of Muskegon field, which precipitated state's last major play, in 1928-29.

Rejuvenated Playa Del Rey field of Los Angeles basin displaces Mountain View as California's "hottest" spot. Run of new flush wells boosts potential daily flow to near Mountain View's top output of 73,365 bbl. daily.

10 years ago

April 6, 1950

American Petroleum Institute directors elect Frank M. Porter, president of Fain-Porter Drilling Co., Oklahoma City, and Mid-Continent Oil and Gas Association, to succeed William R. Boyd, Jr., as Institute president. Boyd retired last November.

Creole Petroleum Corp.'s Alturitas wildcat in western Venezuela passes depth of previous deepest well outside the United States. At 16,702 ft. it is 1,065 ft. below the record depth reached by Colon Development Co., Ltd., (Shell) in its Rio Catatumbo wildcat, south of Lake Maracaibo.

Mail Call

WHAT IS IT about spring that makes our readers want to write us? Our letters-to-the-editor flow is always much higher in March than any other time of year. A secondary peak comes in August.

Maybe you can explain it. We can't.

But the seasonal aspect of our mail from readers isn't half as interesting as its content.

We get letters asking for advice, letters commenting on industry affairs, and (the most common type) letters damning or praising the Big Yellow Book.

Some of these we print in our "They Say" department.

One type we never print—and we get a lot of them—is letters asking an appraisal of prospective oil lands. We tell the writers to find a competent consultant. (Consultants get fees for climbing out on such limbs.)

Other requests for help we do print. One of our more unusual requests came a few years ago from a refinery man who had a pigeon problem . . . or maybe it was a swallow problem. At any rate, he couldn't get rid of the birds roosting in his refinery. We printed his letter asking for advice, hoping he'd hear from others with a similar problem.

A Japanese reader came through with a suggestion. We never heard how it worked and have often wondered if the pigeons are still roosting. . . .

Some of our letters draw a big response. When the world's deepest hole was going down in Texas we mentioned that it was also the world's record for open hole (nearly 12,000 ft.). Immediately a letter came from a subscriber who had over 12,000 ft. of open hole.

That started the ball rolling. We heard from prospective open-hole champs all over the oil patch. Final record (this was in 1957) was a well in Sublette County, Wyoming, with 16,002 ft. of open hole.

Then there are the letters pointing out errors. They're actually the funniest . . . provided you're not the editor who made the error, that is. It's a standing joke around the shop that if you don't think anyone's reading your section, just wait until you make an error. You'll find out in a big way.

Here are some typical "error" letter excerpts . . . "The dry hole shown on your map has not yet been drilled. It is merely a future location." (Migosh! Rather pessimistic of us wasn't it?) "Dear Sir . . . enjoyed your Venezuelan article. However, would you please advise whoever puts Barquisimeto smack in the middle of the State of Yaracuy to 'go west, young man, go west.'" (Our geography is usually excellent . . . just occasionally weird.)

Then there was the time we said "data is." "You've let me down with a bang with this," wrote one reader. Webster says although data is plural in form it may be used as a singular in some cases, we replied in an editor's note. Well we got a perfect squelch letter from an irate reader on this one. "Data is plural and requires a plural verb, regardless of what Webster says," said the reader. "'Ain't' is also included in Webster, but it still isn't correct English."

Did you know that "Sri" was the Indian term corresponding to "Mr." in English? Our proofreaders changed Sri to Sir in a story on India's oil one time. What happened? We heard from Calcutta, of course!

We get plenty of nice letters too. What editor isn't a little thrilled to read . . . "In my opinion the industry owes your publication a vote of thanks for the clear, concise, and fair summation of a most vital problem."

Or how about . . . "As a long-time subscriber we have developed the feeling that the Journal is accurate and factual. This feeling has been further confirmed by your recent presentation."

And, "Hearty congratulations to The Oil and Gas Journal. The industry has been made a political football for too many years. Your leadership in this instance (an editorial) will undoubtedly be a strong influence in helping the oil industry to fight unjust accusations."

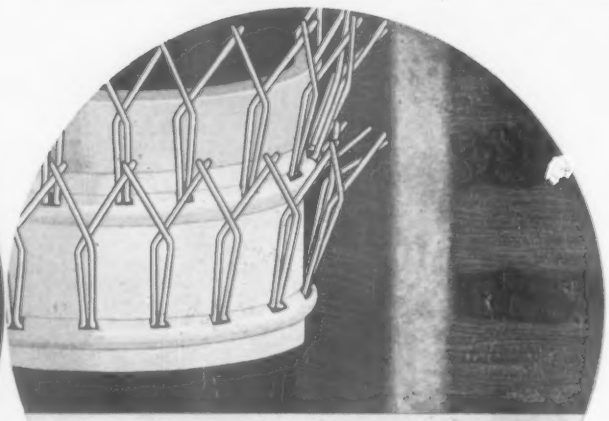
Yes, our letters are sometimes laughable, sometimes inspirational, always interesting. They remind us that we on the Big Yellow Book have a great deal to live up to. It's our responsibility to meet high standards in accuracy, effective reporting, and leadership.

Our readers' letters tell us how well we're fulfilling this obligation.

—Sara Duncan

BAKER CONTROLLED SCRATCHING

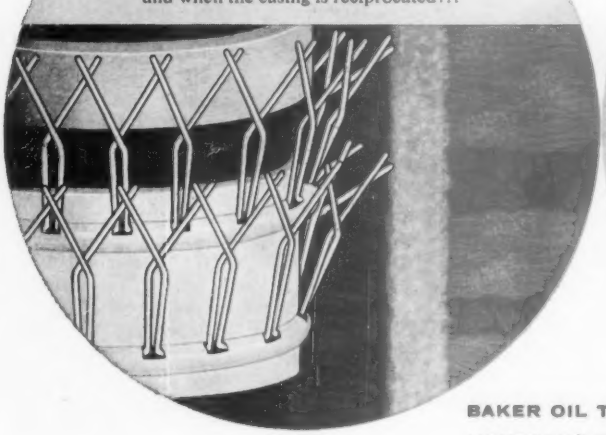
OFFERS MORE THAN EFFECTIVE MUD CAKE REMOVAL



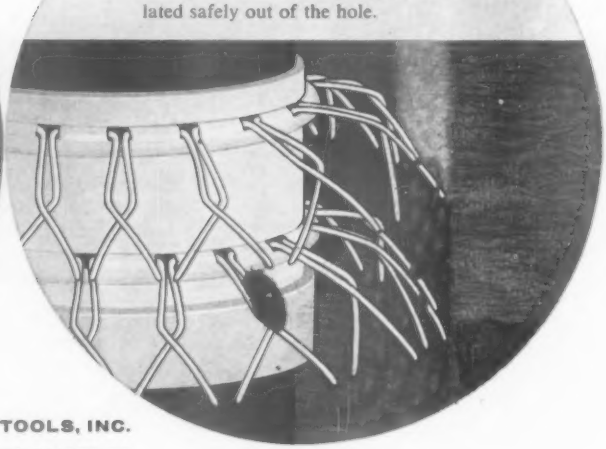
When the casing is being lowered, the scratcher wires swing freely upward and do not remove mud cake which can plug the annulus and cause dangerous pressure surge build-up.

BAKER

After reaching the area to be cemented, the hinged scratcher wires extend to contact the wall of the hole, and when the casing is reciprocated...



...scissors-like operation of the overlapped wires—over the full circumference of the well bore—effectively removes the mud cake which is circulated safely out of the hole.



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HOUSTON/LOS ANGELES
NEW YORK

Controlled Scratching not only means more effective mud cake removal for a better cementing bond, but protects against destructive pressure surges while running casing. Baker Scratchers supplement the pressure-reducing performance of Baker FILL-UP Equipment, and the superior centering action of Baker Casing Centralizers, to provide *more* than a good cement job.

The Baker representative, and your supply store are ready to serve you.

Baker Wall Scratchers are available in the "Solid-Ring Type, (Product No. 901-C) which are slipped *over* the casing; and the "Hinge-Lok" (Product No. 900-C) which fastens *around* the casing. Both types can be positioned with either Solid or Split-Ring Baker no-weld Stop Rings to avoid harmful welding on casing.

Don't look to Washington for gas-bill leadership

PRESIDENT EISENHOWER'S insipid endorsement of natural-gas legislation does nothing to clear away the many roadblocks that are preventing action by Congress this year.

The studied casualness of the wording, timing, and method of his announcement is an obvious attempt to carry water on both shoulders. He is on record for action, but in a way that forestalls action.

It is now clear that the administration is not going to push for a gas bill. It is equally clear, from the reactions in Congress, that the leaders of neither political party want to add this political hot potato to the crowded legislative calendar in what remains of the session in this election year.

GAS PRODUCERS PROFESS to see real hope for congressional action this spring, and are busily drafting new bills. It doubtless is wise to be prepared in case some fortuitous political event should open the way for sudden action.

But there is danger in rushing ahead precipitately. The history of gas bills indicates that a purely producer bill has little chance. Another defeat this year would prevent reconsideration for years to come. And inconclusive congressional debate now might throw the subject into the presidential campaign as a partisan issue.

A series of deadlocks is what has really prevented action over the years. Everybody agrees that the present situation regarding field prices of gas is an intolerable mess. But almost everybody has a different solution.

The inner council of the administration obviously has not been in agreement, as witnessed by the statements that previous bills needed more—but unspecified—consumer protection. The Federal Power Commissioners want legislation, but seem uncertain as to just what form.

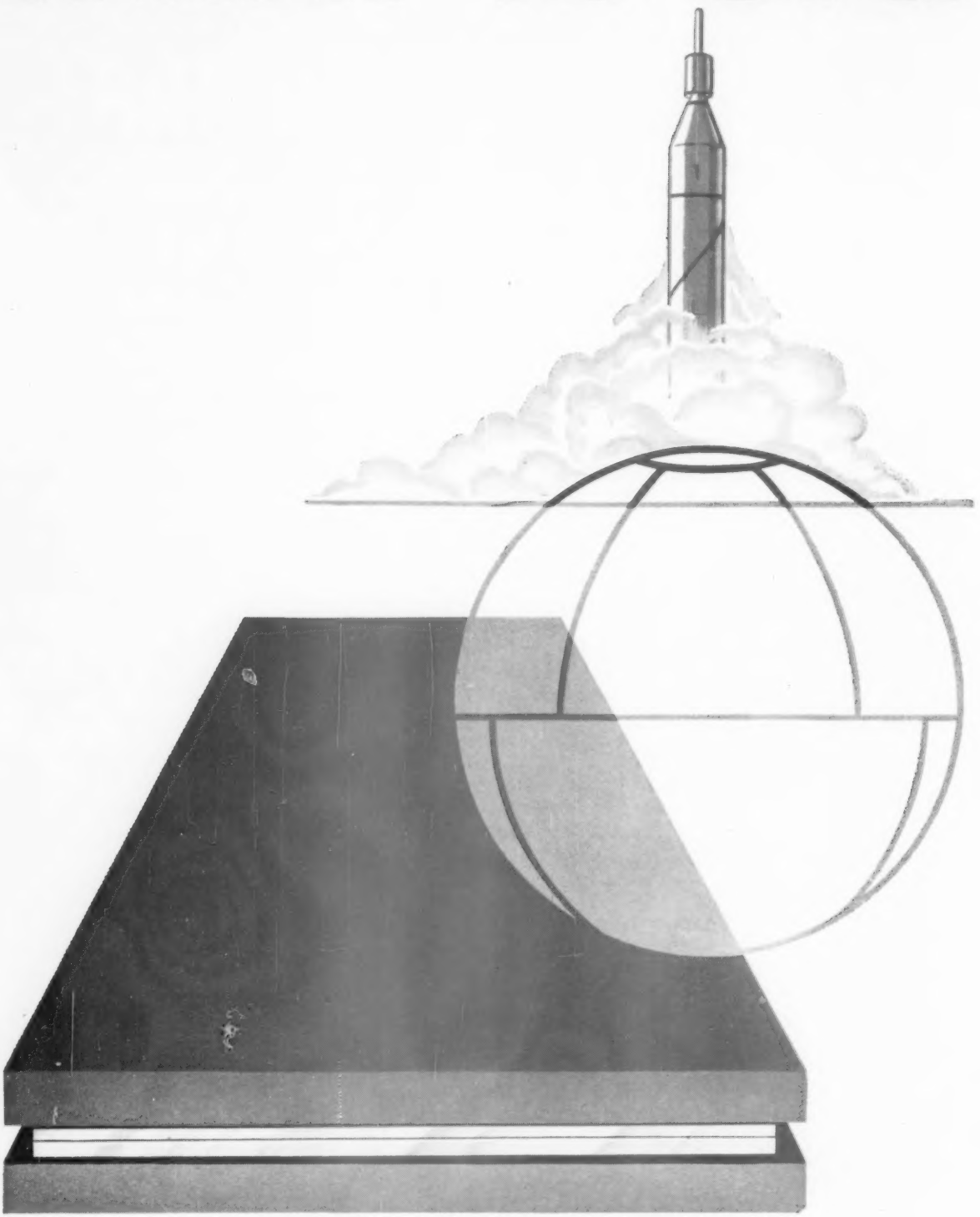
Gas producers, interstate transporters, and local distributors all have special interests which would be hard enough to harmonize at best. But within each group there are wide differences of opinion as to what plan would be acceptable and workable.

THESE DEADLOCKS must be broken, at least in major part, before Congress is asked to take up the matter. Any bill brought to the floor must be reasonably acceptable to all affected interests.

Another intraindustry cat-and-dog fight before congressional committees would be disgraceful and disastrous. To avoid this, all parties should work hard toward sensible compromises, even if this takes months.

It is now clear that no one in Washington is going to take the lead in bringing all parties into agreement on legislation in the public interest. The industry will have to do that itself. And until that is achieved it is fruitless to ask congressional action.

WHAT IS CF&I-

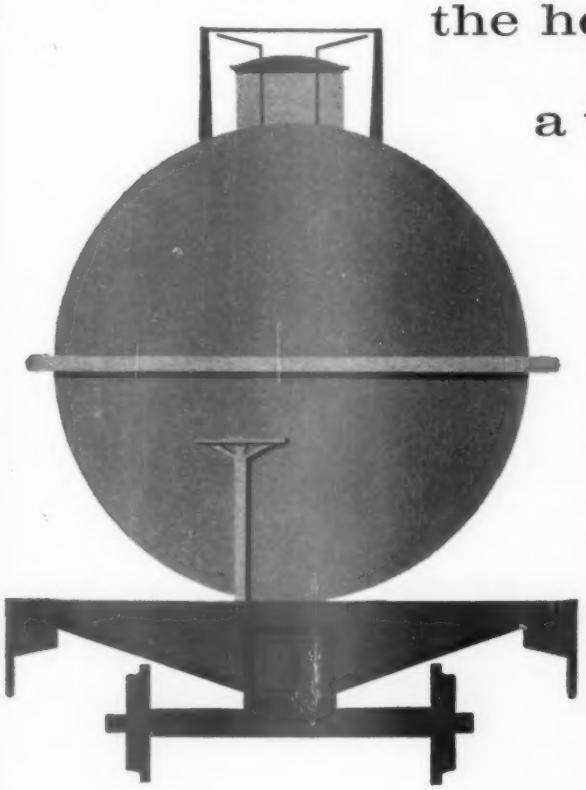


CLAYMONT?

CF&I-Claymont is a steel sandwich...

the head of a tank car...

a vault for missile fuels



Claymont bears the CF&I trademark; it is an important part of this major steel company. Claymont is ability—the ability to manufacture steel plate and plate products to the most demanding customer specifications.

Claymont is an integrated steel mill that rolls carbon and alloy steels into plates of many sizes, shapes and thicknesses. Some of these are made into steel sandwiches — stainless steel plates inseparably bonded to carbon or alloy steel backing plates. These stainless-clad plates are used in many applications requiring corrosion and abrasion resistance. Other plates are spun or pressed into heads, some of which may become integral parts of railroad tank cars. Claymont also makes plates into many special shapes and parts; one example–a container for liquid oxygen rocket fuel.

Claymont invites you to tour our plant whenever you're in the neighborhood. You'll find our modern Fabricated Plate Shop of special interest. In the meantime, you can receive complete information about CF&I-Claymont's facilities and services from any CF&I office.

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Where unusual conditions exist and optimum fluid-loss control is imperative, ask for ADOMITE-MARK II . . . now available from your service company.

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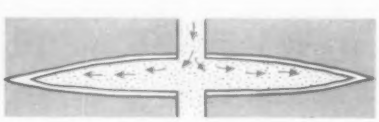
ADOMITE®  *. . . fluid-loss additives*

The Completion Picture in the First Quarter

Sore Spots

	1959	1960	Decrease
Arkansas	222	134	— 88
California	373	309	— 64
North Louisiana	309	246	— 63
Kansas	959	767	—192
Oklahoma	1,406	877	—529
North Texas (7-B, 9)	1,453	1,239	—214
West Texas	1,422	978	—444
Panhandle	337	250	— 87

Bright Spots

	1959	1960	Increase
Indiana	159	205	+ 46
Kentucky	406	466	+ 60
Louisiana, Offshore	92	134	+ 42
Michigan	133	175	+ 42
Mississippi	152	192	+ 40
New Mexico	410	448	+ 38
Ohio	213	265	+ 52
Texas Gulf Coast (Dist. 3)	246	293	+ 47
West Virgina	173	200	+ 27

Total U. S. - 1959: 11,536 - 1960: 10,084 - Decrease-1,452

06J

How Drilling Looks After 3 Months

• It's been the lousiest first quarter in years. The outlook, however, isn't nearly so gloomy. With rare exceptions, the majors still plan to drill as many holes as last year. Independents have been holding back, but they plan to drill more, too. The big problem so far: Too much mud in four key areas.

DON'T CHANGE your operating program because of what happened to drilling in the first quarter.

The rest of the year isn't going to be that bad.

That's the consensus of majors and independents interviewed by the Journal in a comprehensive study of drilling's present ailments.

Here's the outlook:

The major companies, with only a few exceptions, still plan to drill the number of wells they projected when they made their budgets late last year. They will drill almost as many holes as they drilled in 1959. The independents, who generally scheduled more drilling this year, are slow in getting started. But they expect to come close to their original goals, and they could exceed them.

The first quarter was one of the worst for the drilling industry in recent history. Near the end of March the industry was 1,452 completions behind last year, which was no record-setter, itself. That's 121 wells a week below the 1959 average.

But there were many reasons for the poor first quarter, and the biggest was temporary—weather. In some areas it cost more to move a rig than it cost to drill a well. And the weather was worst in some of the biggest drilling areas—North and West Texas, North Louisiana, Oklahoma, and Kansas.

There were other problems, certainly. But the biggest drilling drops were in the areas of alternate freezing and thawing, cloudy skies, rain—and mud. And in these areas the late winter weather was the most severe—and most persistent—in many years.

Most other areas show either a gain in activity for the first quarter or only a slight drop.

Now, take a look at the problem areas:

1. Kansas

Operators in Kansas complain the bulk of their troubles this winter has been with the weather.

Jack Spines of Brunson-Spines, Inc., Wichita, observed: "As far as this part of the country is concerned, I believe about 95% of the slump is due to the weather."

"We've completed one well this year compared with 8 or 9 in a normal first quarter. It costs a driller an extra $2,000 just to move in and move out. From Ellis County and east, it's a quagmire. A 9-day well takes about

14 days. In fact, we've signed for 19 wells and are ready to start just as fast as we can drill them."

Robert Messman of Messman-Rinehart Oil Co., Wichita, said his firm would eventually do as much drilling this year as ever when the weather turned good.

"I've talked to a lot of operators," he said, "and the trouble in Kansas is about 60% due to weather and about 25% to money troubles. Some operators are having more trouble than usual raising funds.

"The weather is the big thing. In Kiowa County our men park on a road 3 miles from the rig and a tractor takes them in. My guess is there will be just as many wells drilled in Kansas this year as last unless the weather makes it impossible to catch up."

Some contend money is harder to come by.

"I've noticed that investors are taking a closer look," said Walter M. Wilkinson, Wichita drilling contractor. "They are disturbed by costs and returns. They should be. It costs just as much and more to drill today as it did several years ago. At the same time we are getting smaller returns.

"This I will say definitely. I can't see a reason for as much enthusiasm in 1960 as we had in 1959. Pipeline proration and publicized industry supply troubles are having a negative effect."

One Wichita operator declared one big factor behind the drilling slump is a hesitancy on part of oil men to drill because they fear the price of crude will drop. "Oil men are not talking much openly about it," he said. "But they see in recent pipeline proration moves a preliminary to a price cut."

2. Oklahoma

Oklahoma oil men are really lagging in their drilling work—529 wells behind this time a year ago.

A feeling of pessimism is felt throughout the industry in the Sooner State. Extremely bad weather is the major factor in the drilling decline. The rest of the responsibility lies with the tough general oversupply situation.

In Oklahoma City, the president of one of Oklahoma's leading integrated companies remarked, "We're becoming more pessimistic. We are cutting down our drilling and decreasing our expenditures."

He explained, "It isn't a question of tight money and we aren't giving up hope—but there has to be a change. This over-supply thing is tough. We're selling distillates the last 3 weeks at the lowest price ever. We just can't keep that up."

Similar expressions were made by a drilling-company executive in Oklahoma City. "My personal outlook as far as the industry is concerned is still gloomy," he said. "I'd like to blame this sag on the weather, but we can't do that forever. Tight money may be having some effect, but I think we were in the doldrums before tight money came into the picture. The industry seems to be continuing at a low level of activity."

The exploration chief of a Tulsa-based integrated Oklahoma company said he has deferred many wells scheduled for the first quarter.

"We may drill them later and we may not," he admitted. "We lean more to wildcat drilling and are discouraging development drilling.

"The whole thing is economic. We're just tighter with our own money and are being a little more cautious where we spend it. That seems to be the general feeling. Our dry-hole contributions and participation program is way down. It's just harder to find someone to make a deal with."

Many independents in Oklahoma sniffed at the majority of the farmouts or other deals being offered these days. "They're mostly dogs—leases of questionable quality," was one comment.

The independents put their finger on the economic sore spot in the Oklahoma oil industry—low allowables, purchaser proration, and weak product prices.

A Chickasha operator with production interests in the Cement and Chickasha fields declared his company had not drilled any wells in 2 years. The shallow prospects in that area are drilled up, the oil operator said.

"There are good possibilities for 15,000-ft. wells. But we can't drill a well like that—we have to wait until some major decides to do it and we'll go in with them.

"I don't see how an independent operator can drill at all. He has to operate on borrowed capital. Allowables are so low you have to pledge 50 to 70% of your production to do the drilling. The independent can barely live in that situation. That's where we are today."

A Tulsa independent said flatly, "Low allowables are the main factor in discouraging drilling. The money we use for our operations comes strictly from crude or bank loans that are backed up by oil. That's our only source."

A Duncan producer and drilling contractor said he was switching most of his activity into water-floods because of their better allowables. "Our plan is to cut down drilling new wells and put the money into developing small floods," he said.

Several independents predicted, however, that a general improvement would come in Oklahoma with spring weather. The state has had one of its wettest winters in years and in many instances heavy drilling equipment has been tied down by mud.

Observed one Blackwell operator: "It'll just take 30 days of sunshine to cure most of this glum talk."

Many operators admitted farmout deals were more plentiful than ever, especially in the northwestern part of the state where a wave of lease expirations is due. These may be the source of renewed activity.

The source of a real drilling upswing, however, would be some really good oil discoveries. Like North Texas, some Oklahoma areas have quit turning up new reserves. One operator put it this way: "We've got to find more oil fields. I drilled 13 dry holes last year."

3. West Texas

This has been the hardest-hit drilling area in the country. Completions in this one area are off 444 from this time a year ago.

One big factor is the slowed-up exploration programs of a few big companies. One firm which has been drilling 500 to 600 wells a year in the region cut back sharply. It had been proving up a number of 15 to 20-year leases which were nearing expiration, and the bulk of the program was completed in 1959.

This hurts the statistical picture, but the company is actually drilling at the rate it projected last year, and it expects to stay with its plans.

Another big operator last year and this year declined to renew many leases it had granted on its fee-owned land in West Texas. The result was a lot of farmouts, drilling deals, and other activity last year which also makes this year's performance look worse by comparison.

Several major-company executives say West Texas has actually been on the downgrade for the last 2 or 3 years because there have been no large discoveries to spur drilling.

Without this incentive, the poor demand, general oversupply, and resulting lowered Texas allowables have made drilling ventures unattractive. In the last 6 months allowables have been down to 9 or 10 days whereas a year ago they ranged from 11 to 12 days.

One major with headquarters in the East, in assessing the West Texas situation, declared it might have to trim its program later in the year if the outlook failed to improve. A company

exploration official observed, "It's better to leave your money in the bank and pick up some interest than to put it into wells that at best can just make expenses."

Another major that traditionally is a leading driller in West Texas reported its 1960 program was at least 10% behind schedule. However, this operator currently has nearly 40 wells in the testing stage near completion and expects to make up the lost time easily during the rest of the year.

Some other majors noted they were drilling fewer wells in West Texas than they expected but spending the same amount of money as budgeted. The reason: The wells are deeper and many are gas wells with wider spacing patterns. One operator's budget calls for about half the wells this year as last but the footage will be 20% more.

The independents . . . Many independents who plan their drilling on a month-to-month basis have cut back for a variety of reasons.

Among them: Low allowables which lengthen payout of a well and fail to provide the cash for new drilling; tightness of venture money; wider spacing; fewer development wells; and lack of good drilling prospects.

One observant Midland independent said he was confident the low Texas allowables were the core of drilling troubles, particularly money troubles.

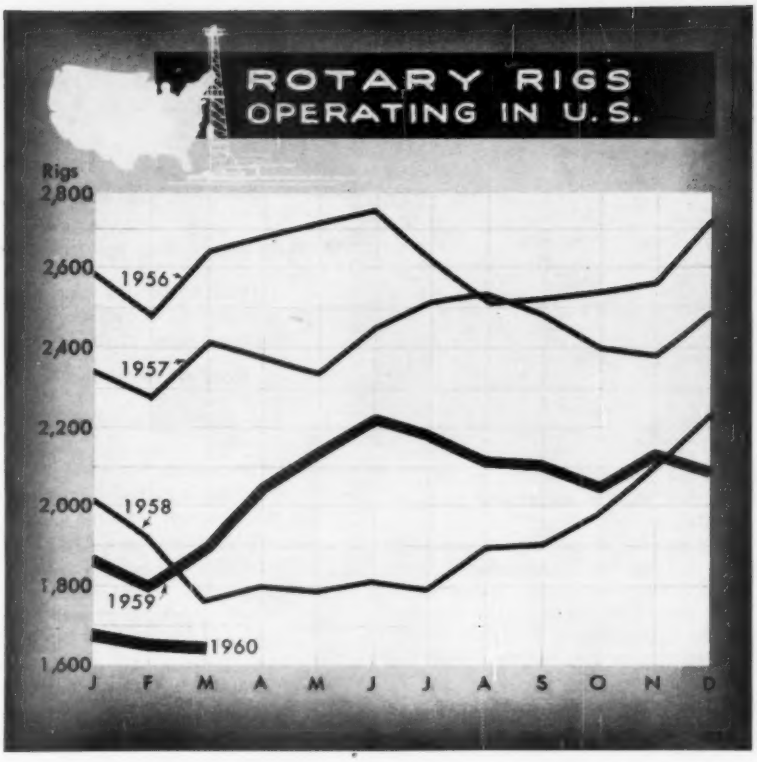
The Midland oil man gives this explanation: Many wells are drilled by small operators who take pieces of drilling deals—say one-eighth or so. The banks have now cut the terms on loans to these operators to 2 years and the amount of the loan is based on his net worth.

Another independent reported he wasn't doing any more drilling until conditions changed. He explained his drilling financing was done back when Texas allowables were running about 15 producing days.

"Now that producing days have dropped to 8, 9, or 10 and have stayed there so long, nearly all the income from our wells is going to the banks. We aren't able to generate new income to spend drilling for more wells. We're sitting tight even if the condition stretches out for 5 years."

One large independent is diverting funds from a usually good-sized West Texas drilling program into offshore wells. The independent was among a group that bid successfully in the recent Louisiana lease sales and needs the funds to foot its share of exploration costs.

No other operators mentioned having to divert funds into offshore work, but several mentioned that the payouts in West Texas were forcing them to put their money in other areas.



The scarcity of drilling prospects was mentioned by another independent. He had figured the majors would loosen up a bit on their farmouts since their programs were cut this year.

"The deals they are offering me stink," he said. "I intend to sit tight. The cost-price trend doesn't make me eager to do any marginal work. For instance, the same casing that cost me $3.15 in late 1955 now costs $4.85. At the same time, the price I get for condensate from the field has fallen from $3.15 to $2.64 a barrel now."

4. North Texas

Two big reasons are given for the particularly low drilling rate in this area: Sloppy weather and a poor discovery rate.

It appears that wet weather this winter has caused North Texas operators more grief than perhaps even those in Oklahoma and Kansas. The North Texans have had virtually bottomless mud to contend with.

Completions are 214 below what they were at this time in 1959.

Marvin McCullough, Wichita Falls operator, estimated 50% of the slump could be charged off to foul weather. McCullough had planned to have at least six wells drilled by this time but has been able to get the rigs into only two locations. His expenses jumped sharply on these. On one, he had to use a dragline to dig the mud pits because the bulldozer scheduled for the job was buried in the mud.

Lack of good drilling deals also is hurting North Texas drilling, according to McCullough. Reserves the oil man might expect to find are not large enough to justify spending the kind of money needed to drill the wells.

Most discoveries being made now in North Texas are in the Caddo and Mississippian pays ranging from 4,000 to 6,000 ft. These discoveries have been the "small, hicky-type fields," McCullough said.

Another big independent operator in Wichita Falls who asked anonymity says he has had six rigs sitting idle on location for a month to 6 weeks because he couldn't get them out. All had jobs waiting.

He had cut his North Texas operations one-fourth and was beefing up his drilling in other oil areas. He gave this rundown on reasons for the drilling decline there: New discoveries aren't coming up with decent reserves. Wells seem to get smaller and smaller. Crude prices are static or declining, and costs keep going up. Margin of profit is getting very close. Add to this the fear of many producers that crude prices may start falling again, and it gives a glum prospect for drilling.

A third Wichita Falls operator who

also drills in California, Oklahoma, and the Rockies agrees that poor drilling prospects are the No. 1 problem in North Texas. He said things would really hum if someone could come up with a really big discovery. He wagered operators would forget low allowables, tight money, and low prices then.

"Look at East Texas during the boom there," the Texan recalled. "Even when crude fell to 25 cents a barrel because of the terrific flood of oil, more than 1,000 rigs were running in the field. Why? Because of the lush reserves."

5. Elsewhere

A stabilizing force which should help the seasonal upturn in drilling this year is the announced plan of the majors.

Practically all of them insist they have not cut back materially on their 1960 drilling programs. Some admit wells have been deferred in the first quarter. A few have reduced drilling in a particular area but may shift the budget to other work.

In California, for example, where completions are down nearly 20%, operators say they expect to make up this ground in the remaining three quarters.

One major operating in the Mid-Continent says much of its scheduled work has been deferred. Reasons were bad weather in Oklahoma, Kansas, Illinois, and Michigan, coupled with the slowness of partners to complete paper work in many ventures.

This company also entered 1960 with far fewer uncompleted wells than usual. It completed its 1959 program nearly on time, which means fewer completions in 1960, even if it makes no cut in its drilling program.

Aside from the amount of drilling to be done, here are some things industry executives see in the months ahead:

... **Greater emphasis** on gas exploration.

... **More farmouts.**

... **A big drilling** program in the Oklahoma Panhandle as a result of new 80-acre spacing for deep Morrow wells.

... **A continuing** scarcity of really good wildcatting prospects.

... **Continued good** economic conditions in the eastern gas areas and in the Penn Grade crude-oil region.

In brief, oil men agree that the first quarter was a dog for the drilling industry. The worst problem—weather—is almost solved. Some will remain, but even so, the last three quarters should see a big improvement.

watching WASHINGTON

Clyde La Motte

• Are we going to run short of residual fuel?

THIS HAS BEEN a relatively quiet year for oil in Washington, but the pot is beginning to bubble on several issues.

Here are some of the spots where controversy is growing:

... **Residual fuel imports.** This has flared into the hottest oil controversy in Washington.

The question is whether a residual fuel shortage is pending, and if so, why.

Here is how the issue developed:

Coal interests had complained that some major importers were bringing their current 6-month quotas in as rapidly as possible in an effort to create the appearance of a shortage later so that they could press for higher quotas.

Under Sec. of Interior Elmer Bennett reassured the coal people that it did not appear at present that any increase would be necessary.

This prompted M. J. Rathbone, president of Standard Oil Co. (N. J.), to write Interior. He gave sharp warning that a shortage was imminent and criticized the Department for its handling of the program.

Last week Bennett fired back a reply to Rathbone. In it, Bennett took the company to task for its rate of resid imports and implied that Jersey Standard had not acted in a responsible manner. He pointed out that whereas other importers during January and February brought in an average of 47% of their 6-month quotas, Jersey Standard imported 70% of its quota in those 2 months.

Bennett further implied that some resid is currently being sold at distress prices. He said the control program was not designed to create a set of conditions under which "unlimited residual fuel oil could be imported and sold at distress prices."

Bennett did say that should it appear overall that a residual fuel shortage was developing, Interior would increase quotas. But he made it abundantly clear that Interior would not do so simply because one or two companies, however large, had exhausted their quotas.

Outlook: There will be more fireworks before this issue is settled. Each side realizes that it is the first real showdown fight under the import control program, and neither is likely to yield ground willingly at this point.

... **Natural-gas legislation.** Producer groups have hopes of getting this issue off dead center. The apparent strategy is to draft a specific bill, get it introduced in Congress and approved by at least a few of the congressional leaders, and then take it to the White House in the hopes of getting active support from the President.

Outlook: Still dim. Time is running short.

... **Fuels policy study.** Despite the fact that the coal industry has backed away from the end-use control aspects of the original resolution, many in the oil industry feel that the intent of the coal group remains the same. Therefore, opposition to the establishment of a special congressional committee to make a study of fuels resources still exists.

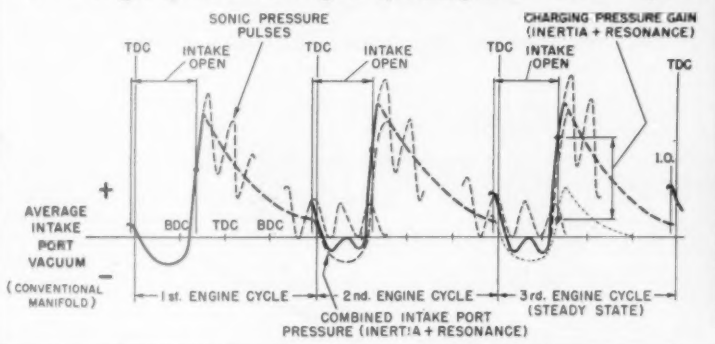
Outlook: The resolution probably will not be passed this year. But coal may use it as a bargaining point, especially if any real drive develops for gas legislation.

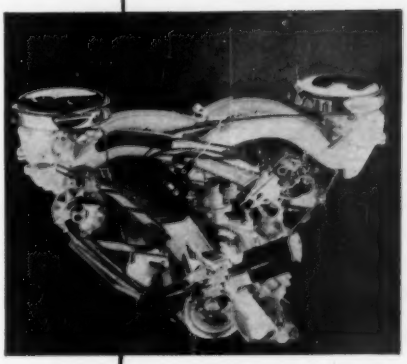
... **Tankers.** Some U. S. tanker owners have pressed for a requirement that 50% of imported oil be brought in by tankers flying the U. S. flag. Strong opposition has developed to this move.

Outlook: The Office of Civil and Defense Mobilization will probably reject the request, justifying its action on statements from State and Defense Department officials that such a step would do the nation more harm than good.

A Look at Ram Induction

. . . in single-cylinder test engine operating at its resonant speed





Will Ram Induction Make the Grade?

• Unlike some systems designed to perk up engine power, Chrysler's new device has no moving parts. It uses mass inertia and sonic resonance effects to obtain supercharging.

FINDING new ways of getting more performance out of an automobile engine is a constant objective in Detroit.

The most common route in recent years has been increasing compression ratios. But other methods have been tried.

In 1957 Studebaker equipped its Hawk with supercharging. It was a plus value—but it failed to catch on as a selling point.

Later, General Motors went in for fuel injection. Last year it was optional on Chevrolet and Corvette. But it didn't make the grade and has been dropped.

Now, Chrysler Corp. is taking its turn. Chrysler has come up with an entirely new high-performance device—"ram induction."

What it is . . . Ram induction, Chrysler engineers say, produces an effect "similar to that provided by a mechanical supercharger." A big difference is that the new system has no moving parts.

Chrysler's unique system is described as the use of "mass inertia and sonic resonance effects to obtain free supercharging." It uses sonic impulses, traveling inside 30-in. manifold tubes, to create pressure pulses which permit outside air to be rammed with fuel into the firing chamber.

Ram induction, say Chrysler engineers, represents a practical application of the two physical properties of inertia and resonance. By use of intake pipes of varied length, inertia and resonance can be used to improve the breathing capacity of an engine. The length, and to a lesser extent the diameter, of the intake pipe determine the speed at which improvement in volumetric efficiency takes place.

The effect of ram induction is to pack an extraordinary amount of fuel-air mixture into the engine, thus securing a sizable power increase as compared to conventional induction systems.

Ram induction permits the recovery of some of the pumping losses normally involved in supplying fuel-air mixtures to an internal combustion engine. The result is a peak increase in torque or horsepower of 10% or more. This can be accomplished over a speed range of about 1,800 r.p.m. By varying design details, the "tuned" speed range may be placed at almost any point in the engine speed range. It may be tuned for exceptional torque output or maximum power output.

Chrysler has picked mid-speed tuning for the system because of the need for quick passing on highways. This provides a noticeable torque increase between 2,000 and 3,800 r.p.m., with the peak boost occurring at 2,800 r.p.m. Thus, increased performance is obtained without increasing the engine size.

Chrysler engineers cite these selling points for ram induction:

. . . **Acceleration** for quick passing on highway.

. . . **No rough** low-speed operation usually associated with powerful high-performance engines.

. . . **Simplicity** of the system precludes the mechanical difficulties often associated with superchargers, fuel injection, and other high-performance equipment.

. . . **Since ram tuning** is most effective at full throttle, the part-throttle operation and economy are unchanged from that of a conventional engine. This, in effect, gives the owner "two engines in one": A very powerful one for passing or other maneuvers and an economical one for ordinary driving conditions.

Like supercharging and fuel injection, ram induction is an extra-cost option. It's available on several Chrysler makes, including Dart, Dodge, Plymouth, and DeSoto. Its extra cost is around $330, about the same price tag on fuel injection a year ago.

Whether ram induction will make the grade or follow the path of its predecessors is yet to be determined. Few oil companies, with most of their attention focused on the fast-selling compacts, have had a real good chance to take a look at it.

However, one engineer who has taken more than a cursory look at ram induction, commented: "It works."

UOP's New Process Offers Flexibility

• WPRA is told that yields of gasoline and middle distillate can now be varied by new Lomax unit. Favorable cost figures also are cited.

A NEW CATALYTIC hydrocracking process, "Lomax," is now available to refiners seeking greater flexibility in their gasoline or middle distillate yields.

Where middle distillates are a problem, they can be hydrocracked to better than 100% yields of high-octane gasolines. If a heavy gas-oil feed is used, either middle distillate or gasoline yields can be maximized as desired. In all cases there is no excessive fuel gas production.

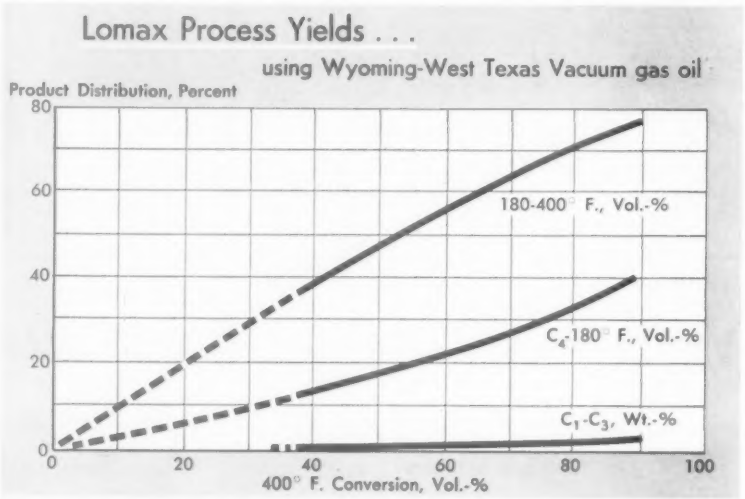
Lomax was announced by Universal Oil Products Co. last week at the San Antonio meeting of the Western Petroleum Refiners Association. It can be fitted into typical refinery schemes in a variety of ways and at favorable investment charges and operating costs, UOP's M. J. Sterba and C. H. Watkins said.

In contrast with cat cracking, the new process produces no catalytic deposit, a much smaller quantity of light hydrocarbon gases, and essentially olefin-free products. Other process features stressed include:

...Light naphthas produced are composed predominantly of the branched isomers of butanes, pentanes, and hexanes.

...Aromatics in the feed can be either saturated or substantially retained.

...Complete recycling of material boiling above gasoline can be carried out without sacrificing yields or quality.



Product distribution . . . Experimental data were presented on a variety of charge stocks. Kerosine, stove oil, gas oils, coker distillates, catalytic cycle oils, and other such distillates from catalytic or thermal operations can be used.

In pilot plant operations with such charge stocks at a 60% conversion level, it was found that:

Yields of butane-plus materials increased with the higher boiling point materials, but the ratio of light naphtha to heavy naphtha varied considerably.

Different process conditions can be used to vary these product distributions. Thus the product distributions are not solely a function of the charge stocks used.

As an example of the product distributions obtained from a given charge stock, four different process conditions were used with a 28° API gas oil.

New Sinclair Approach Makes Knock Engines

IN REFINERIES throughout the country, operators run from 2 to 12 test engines—or more—as a check on their gasoline quality.

But the refiner's problem has always been that different engines produced different results.

There are inherent cylinder differences. The engines have different amounts of combustion-chamber deposits. And even changes in barometric pressure affect the quality rating given a gasoline by the test engine.

Last week Sinclair Research Laboratories disclosed it has found a way to make engine test results more precise.

It has developed tables and charts, it said, which will compensate for the different engine conditions and will produce accurate ratings of gasoline quality.

The Sinclair approach to knock-engine testing was outlined to the Western Petroleum Refiners Association by Bruno R. Siegel, who told the refiners that the extra time required for calibrating the engines is more than made up by reduced down-time and break-in time.

What's new . . . In the past, said Siegel, engineers have tried to reach a uniform combustion environment by "super standardization" of equipment and operating conditions.

They have tried to get precise results by operating each engine at the same inlet temperature and at a given compression ratio for a given octane number.

The Sinclair approach, he said, calibrates engines to even closer tolerances. It changes operating conditions to compensate for design differences, engine deposits, and degree of wear.

Sinclair's technique recognizes that knock intensity per se also has a marked effect in ratings.

Siegel said that engines characteristically rate fuels lower as deposits increase, and immediately after overhaul they overrate.

Sinclair brings the average engine in line by changing the inlet temperature or the compression ratio, or both. Sinclair has developed tables for it. They can be used for both motor and research methods.

At 50% conversion the recoveries of butane-plus liquid products was about 114% (volume) in all cases. The light naphtha fraction, however, varied from 13 to 21%; the heavy naphtha fraction, from 53 to 43%; and the middle distillate fraction (400-650° F. boiling range) varied from 28 to 13%.

Data also were given to show how Lomax can be applied to maximize middle distillate production. A vacuum gas oil obtained from mixed Wyoming-West Texas crude was used (see diagram for product distribution). The feed had an initial boiling point of 590° F. and contained only 3% of material boiling below 650° F.

When it was desired to maximize middle distillate production, the ratio of middle distillate to gasoline was about 2. By processing for gasoline the same ratio was less than 0.5.

Economics of the process . . . Factors now favor fitting a Lomax unit into various refining schemes, the UOP engineers believe.

In a refinery where excess FCC light cycle oil is available, a 3,590-bbl. Lomax unit would have a payout time (before taxes) of about 2.5 years. A 1.5-year payout was shown in a hypothetical case where 9,800 bbl. of 400-650° F. virgin distillate was Lomax processed, using hydrogen available from a cat reforming unit.

As an example of the new unit's operating costs, the UOP engineers said they would total about 31 cents per barrel in the case of the 9,800-bbl. unit. Utilities accounted for 19 cents; maintenance, taxes, and insurance for almost 7 cents; and catalyst and chemicals, 3.5 cents. These costs were exclusive of any royalty.

Tell the Truth

First step . . . Siegel said that engines in good mechanical conditions can be calibrated to "zero deviation" in the ratings of standardization fuels.

It validates Sinclair's temperature-density approach but final proof lies in a future examination of precision.

The tables developed from the new method are not final but are considered as a first step, Siegel said. They may be considered as an eventual replacement for compression temperature as a severity scale.

The extra time required for calibration by the new method is more than compensated for. Time between deposit removals is increased and the use of correction factors for engines known to rate high or low is eliminated.

Stormont New Refining Editor

DAVID H. STORMONT, a senior member of the staff of The Oil and Gas Journal, will move to New York May 1 as refining editor.

Stormont for the past 10 years has headquartered in Los Angeles as West Coast editor. He has been on the Journal's editorial staff since 1935, 1 year after his graduation from the University of Oklahoma with a degree in chemical engineering.

He began his Journal career in Tulsa. In the late 1930's he moved to Fort Worth and was in charge of that office until entering the Army in 1942.

He returned to Tulsa after being discharged in 1946 as a major, and 2 years later was transferred to Dallas. He was transferred to Los Angeles in March 1950 and has been in charge of the California office since then.

Luminometer May Find Better Jet Fuels

NORMAL paraffins, which burn cleaner and cooler than other hydrocarbon fuels, are being eyed as superior jet engine fuels.

These desirable qualities—lower temperatures and less smoke—are measured in the luminosity rating of the fuel.

An indication of the luminosity rating of fuels can be furnished by a luminometer developed by Pratt & Whitney Aircraft. E. A. Droegemuller discussed the development of the instrument at the WPRA meeting.

A fuel with low luminosity is a must for high quality jet fuels. Such a fuel has a high luminometer rating. The straight-chain paraffins, because of their high percentage of hydrogen, have a high rating. Droegemuller said the unbranched paraffin fuels provide greater heating value per pound and thus allow greater payloads.

The superior properties of paraffins also extend to high speed Mach 3 applications, he said. Their better specific heats enable them to provide more cooling than either napthene or aromatic type fuels.

Luminosity of jet fuels affects not only thrust, but temperatures of jet engines. Those fuels with poor burning characteristics — the aromatics, naphthenes, and olefins — impose higher temperatures on metal parts of the jet engine and represent an engineering problem today.

Refiners attending the meeting expressed some reservations on the attainment of high luminosity number fuels for military needs under present circumstances. They can make some progress through better feed-stock selection. This restricts the potential supply, however, and if massive volumes of high quality jet fuels are to be needed, further processing is in order.

Oil-Stock Buying to Perk Up in 1960

THE 1960 STOCK market should be a good one for oil. Many stocks are now a real bargain. They have good price-earnings ratios and have good book values.

So, look for increased buying of oil stocks by the professional investors in the pension funds and investment trusts.

William I. Spencer, senior vice president of First National City Bank of New York, disclosed these trends at the annual WPRA meeting.

He said that in 1957 oil ranked first in dollar value of stocks listed and traded on the stock exchanges. Now, oil ranks third, behind the utilities and chemicals. In 1957, many of the investment portfolios had 20% to 25% of their stocks in oil. He said the downward adjustments are over.

Oil stocks declined in popularity because of the combined effects of imports, the influence of natural gas on oil markets, and the erosion of crude-oil prices after Suez.

Wilmington Operators Form Units

• It has taken months of committee work to hammer out terms for unitizing Blocks II and III in Long Beach's Wilmington field, but now operators have a model to follow. It should speed up work on million-barrel water flood.

TWO YEARS of intensive negotiations have been capped by success with the unitizing of the bulk of operators in Fault Blocks II and III of California's Wilmington field.

The two units are expected to set the pattern for other unit agreements in the field, where a 1,000,000-bbl. daily water flood is being built up to halt subsidence in Long Beach.

Here's how the two units stack up:

. . . **Fault Block II.** The unitized area includes 80.3% of the block's production. Unit members include Union Pacific Railway, Mobil Oil Co., and Ford Motor Co. They produce 8,480 bbl. of 22°-gravity crude from 306 producing wells. There are 24 injection wells in the block with 27 more planned. Currently 87,784 bbl. of water are injected daily in this block.

. . . **Fault Block III.** The unitized area of this block include 79.1% of the production in the block. The participants include Union Pacific and Southern California Edison Co., a major electric utility with substantial holdings in the field. They produce 5,300 bbl. of 21°-gravity crude from 190 wells. There are 47 injection wells in the block with six to go to fill out the planned injection program. In this block 120,091 bbl. of water are being injected daily.

Both unit agreements are the same, except for different boundary descriptions and voting controls. They contain many unique features not found in so-called model forms of agreements. Some of these features include:

. . . **Each unit** consists of two segments with an operator for each segment. Union Pacific will operate upland areas and the Long Beach Harbor Department will operate the tidelands segments of both.

. . . **Agreements** provide for test procedures where necessary to segregate production between units and between unitized and nonunitized areas.

. . . **Deliveries** will be made to working interest owners at special points. Rather than unit-wide commingling of production, deliveries will be balanced from time to time so that each party will receive an average gravity over a specified period of time. This agreement phase was submitted for approval to the Internal Revenue Service to preclude future tax problems.

. . . **The city-financed** water systems, including source wells, pumping plants, and distribution lines, will be amortized back to the city by a charge added to the operating expense of the units.

. . . **Because** of the need for speed and the big technical problems involved, exact equities were not agreed on prior to unitization. Values of 1958 production were used to determine interim equity participation. Final equities will be determined using engineering formulas included in the unit agreements. Those formulas call for setting primary participations in production until primary reserves are recovered, based on relative present worth of future net revenues.

When primary reserves are recovered, participation factors will be based on the relative volume of productive sands contributed by the parties. Weighting factors will be applied to adjust for variations in gravity and probable recoveries of the various producing intervals. Both primary and secondary participation factors govern distribution of unit costs.

. . . **Because** of the high surface values of the lands in the units, each party was permitted to reserve portions of surface areas for purposes other than oil production. Additional surface areas can be withdrawn by operators, but they must foot the cost of rearrangement of flooding facilities.

Provisions were also made for considering surface values in setting the basis for termination of the units. The units can be ended in 20 years if they become uneconomical.

. . . **Unit-boundary** descriptions are three dimensional. Cross-section maps were used to define subsurface geological structures of each unit. The lower zones of Fault Block II unit substantially under the producing zones of Block III due to the hade of the fault separating the two units.

Possible members . . . The south flanks of both blocks are tidelands areas operated by the City of Long Beach under grant from the state. The city has the go-ahead from the State Lands Commission to enter both unit agreements. However, this action is being held up pending clarification on whether tidelands trust properties can join unit pacts.

Pending final determination, the city plans to continue operating floods from its properties under terms of a cooperative agreement negotiated last year with the private operators.

Both units have provisions on how to figure retroactive oil allocations and costs if the tidelands come into the units prior to March 1, 1961.

Signal Oil & Gas Co. holds considerable acreage north of both units. The company plans to join the units as soon as it can get consent from more than 800 royalty interests involved. There are 14 operators in the nonunitized portions north of Block II and 6 north of Block III.

Background . . . Union Pacific, the largest producer in the blocks, has spearheaded much of the work since it was decided late in 1957 by Long Beach officials and the oil companies that unitization offered the most hope for speedy repressurization in the field. The city and companies also agreed unitization by fault blocks was the best approach.

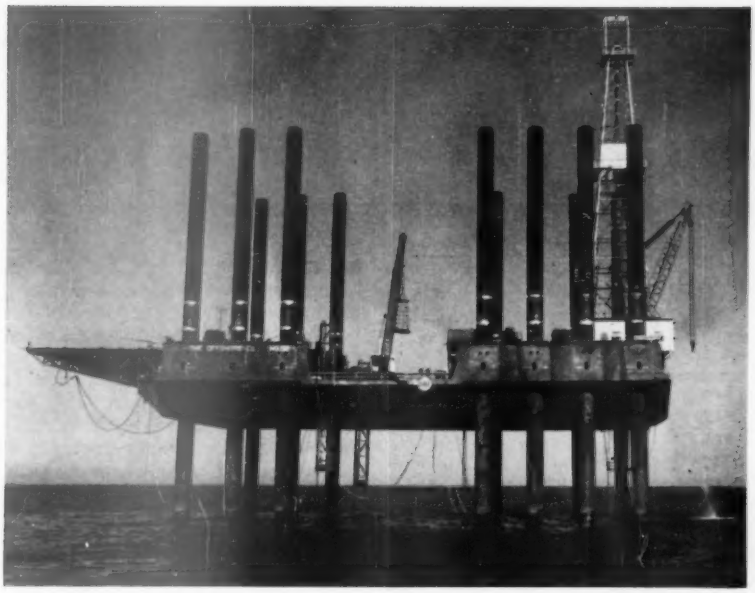
By June 1958, the major producers had signed a letter of intent to unitize.

Recent surveys indicate subsidence has been halted in the Long Beach shipyard area overlying the south flanks of both blocks. Last February, Navy Secretary William B. Franke said the Navy was satisfied with the flood's progress and the big base would continue operating.

PIPELINE

A 63-mile 8-in. trunk line and a gathering system to serve Sacotosa oil field in Maverick County, Southwest Texas, will be built by Humble Pipe Line Co. Construction contract will be let soon and the project will be completed early in the summer. The connection will extend Humble operations into a new area and will tie in with its system at Pearsall, Tex.

A 200-hp. electric pumping unit will be installed near Artesia, N. M., on Service Pipe Line Co.'s line serving the Empire Abo field, Eddy County. Capacity will be increased from 6,000 to 11,000 bbl. daily. Two miles of 4-in.



OFFSHORE Co.'s Rig 52 is drilling for Gulf near Key West, where . . .

Porous Coral Poses Problem

. . . in Gulf's second deep test in Florida waters. Aerated seawater is being used as a drilling fluid.

GULF OIL Corp. has been forced to resort to unusual drilling practices to sink its current deep test in the porous formation off Key West, Fla.

Now below 12,500 ft. and headed for 15,000 ft., this offshore well contains a canvas sleeve in the upper portion of the hole.

Midway in the drilling, aerated seawater was used as a drilling fluid to establish returns — and the returns amounted to 5 or 10 times as much water as was pumped into the hole.

Gulf is operator on its Marquesas OCS Block 28 well, located 35 miles southwest of Key West. The wildcat is on a federal lease acquired last year jointly with The California Co.

The company did not state whether any oil shows have occurred, but apparently there has been no time-out for testing yet. The Offshore Co., the drilling contractor, has drilled at a record rate for Florida waters, which so far have proved unproductive.

The well was spudded January 16 in 36 ft. of water, and drilling last week was more than 50 days swifter than a dry hole drilled by Gulf last year 20 miles to the east-northeast. The 1959 well, the State of Florida 826-Y, was on a state lease and went to 15,474 ft. before it was abandoned.

The hole . . . In the current well the operators drilled a 24-in. hole for the first 790 ft. and, after electric logging, set 20-in. casing at 786 ft.

Because of the porous coral, a pleated canvas sleeve was used to line the wall of the hole and support a column of cement for fill around the casing.

Below 790 ft. the hole was narrowed to 12¼-in. to a depth of 7,728 ft. At this depth Gulf was using seawater for drilling fluid because of lost returns in the porous formations.

The annular column was lightened so much, however, by the aeration that tremendous amounts of water were produced from the formations. This helped to keep the hole clean. The addition of lime was required to inhibit corrosion which results from aeration.

Gulf decided it had drilled through sufficient impervious material at 7,728 ft. to set an intermediate string of 9⅝-in. casing. Below this depth the hole has been drilled at 8⅝ in. to the present depth. The operators have averaged 246 ft. of hole per day while drilling the 8⅝-in. hole.

Lime-treated seawater is still the drilling fluid, although at 10,000 ft. the operators substituted mud for sea water for a time to increase the size of formation cuttings.

The Offshore Co. is using four WEK compressors and two RXD boosters to supply air for the job. The diesel-powered units are rated at 1,800 cu. ft. of free air per minute at 1,800 psi. maximum pressure.

BRIEFS . . .

gravity lines will be laid to connect four more leases. Service laid a 44-mile 8-in. line to connect the field to its system last August.

A construction program of 179 miles of 4, 6, and 8-in. gas line is planned this year, in addition to distribution lines and laterals by Saskatchewan Power Corp. Contract will be let later for the extensions, varying from 25 to 60 miles in length.

Some 700 billion cubic feet of gas reserves in the Elk City, Okla., field have been sold by Shell Oil, 75% owner, to Panhandle Eastern Pipe Line. Sale price was 17 cents an M.c.f., comparable to what the FPC has approved in the area, plus 3 cents for gathering and dehydration. Panhandle is expected to lay a line from Elk City some 130 miles to its main system in southwestern Kansas. The reserve will provide a sizable share of the supply needed for Panhandle's 400,000 M.c.f. daily expansion program pending before FPC (OGJ, March 21, p. 85).

Contract for 22 miles of 12, 14, and 16-in. gas line near Belleville, Ill., has been awarded to Cape Construction Co., Inc., by Illinois Power Co. The project will get under way by April 30.

Also for Pipeliners . . .

IN THE NEWS: Pipeliners get a look at Great Lakes Steel's new high-strength pipe which welds easily (p. 71) . . . Texas banker says there's no better investment than natural gas (p. 77).

PLUS THESE TECHNICAL REPORTS: Strain gages determine secondary stresses on pipelines (p. 92) . . . Save money with X-52 welded repairs (p. 121).

California's Waste-Water Woes Grow

• San Joaquin Valley fields have the biggest water-production rate, with the water cut for all wells averaging 78.7%. The oil companies have put millions of dollars into disposal systems and face prospect of spending more.

CALIFORNIA'S steady increase in oil field water production and the postwar population boom are working together to pinch oil operators.

Formerly, most of the state's high water-cut fields were in remote, undeveloped areas. However, both agricultural and urban developments have been crowding in on them steadily. The problem is particularly troublesome in the San Joaquin Valley.

The almost startling changes in the situation can be quickly sized up in a study of water-cut trends and population growth statistics. In brief, here's what's happened:

... **Water production** had climbed to an average cut of 72.7% at the start of this year. The state's 36,195 wells were producing 2,224,000 bbl. of water to 835,000 bbl. of oil. In 1946, the 23,180 wells averaged 1,209,000 bbl. of water daily to 862,000 of oil, or an average water cut per well of 57.9%.

... **Population** in the state has doubled from 6.2 million to 13.4 million in just 20 years. Experts estimate there'll be 24 million residents in California by 1975.

This population explosion is having its effect on waste water disposal on several counts. For one, California is experiencing a growing fresh-water shortage. Because of this, state water pollution control officials are getting more strict in their efforts to protect subsurface fresh water tables from possible contamination by percolating oil field waste waters.

Also, values of properties around oil fields are increasing as residential developments move in on them, forcing operators to upgrade surface facilities used in disposal systems.

Thus far, and in the foreseeable future, the oil industry has done and is planning to do a highly efficient job in meeting the costly problem.

At last count, oil companies had a $13.1-million investment in disposal systems operating at an annual cost of $3,735,000.

Cooperative ventures . . . Most of the state's oil field produced waters are being taken care of through cooperative waste water disposal companies.

Some of the bigger ones and their areas of operation include: Valley Waste Water Disposal Co. (San Joaquin Valley), Santa Fe Springs Waste Water Disposal Co. (eastern Los Angeles Basin), Waste Water Disposal Co. of Fullerton (Orange County), Oil Operators, Inc. (Signal Hill), and Santa Clara Waste Water Disposal Co. (Santa Paula coastal area).

In addition to the cooperative ventures, and individual company systems, Union Oil Co. of California operates a system in the Santa Maria-Cat Canyon area available to others. There also is a salt water disposal pipeline owned by three companies which runs from the Ventura Avenue field to the ocean that others can use.

In general, four methods are employed in the state to dispose of oilfield waters. Of the 2.2 million barrels produced daily, ocean discharge accounts for 550,000 bbl., reinjection accounts for another 400,000 bbl., 600,000 bbl. is taken care of in evaporation and percolation sumps, and 650,000 bbl. is of good enough quality to be used for agricultural purposes.

Reinjection will probably be called on to handle the bulk of future increases as tighter restrictions are clamped on ocean discharge and sumps due to the population growth.

Use of sewer systems in the state is highly restricted because of volume problems. In California, oil field waste waters are strictly a "poor relation." They can get into sewer systems only when everything else, including other industry waste waters, has been handled by the systems.

In some cases, the produced waters must be pipelined to remote areas before they can be disposed of in sumps. This is particularly true of certain San Joaquin Valley fields where the produced water is so bad it constitutes a menace to fresh water and is unfit for agricultural use.

Even on the coast where the bulk of waste water is dumped into the Pacific, operators frequently have to treat the water first. Californians place a high value on their beaches and harbors and fiercely protect them from any pollution threats.

And after everyone else has been satisfied, oil producers always have the fish and game people to contend with in waste water disposal. The wildlife officials keep a critical eye on all waste disposal operations and play a key role in setting standards.

For administrative and enforcement purposes, the state is divided into nine water pollution control districts, each with a board appointed by the governor. These boards set the water disposal standards in their districts. Every case is considered separately.

Biggest contributor . . . San Joaquin Valley is the biggest contributor to the state's oil field produced waters. It accounts for 1,394,000 bbl. daily. Areas along the coast contribute 235,000 bbl. daily and the Los Angeles basin 595,000 bbl. daily.

Water cuts of 90% aren't uncommon in San Joaquin Valley fields. One extreme case is the Vedder-Baker pool in the Mt. Poso Field, Kern County. This pool's 16 producers were making 116 bbl. of oil and 11,687 bbl. of water daily for a cut of 99%. That's 730 bbl. of water for every barrel of oil. San Joaquin Valley wells lumped together average 78.7% water cut.

One saving factor is that a substantial quantity of the water in the Valley is suitable for irrigation. However, about half of the Valley's 1.4 million barrels daily must be run to sumps or reinjected.

All of the re-injected water isn't a total loss. An estimated 50% has secondary-recovery values.

Typical plants . . . Oil companies put

Water flow in California

Year	B/D Water (000)	No. Wells	B/D Oil (000)	% Water Cut
1946	1,209	23,180	862	57.9
1947	1,296	24,421	915	58.3
1948	1,379	26,472	932	59.2
1949	1,291	24,365	915	59.8
1950	1,499	28,102	900	61.0
1951	1,568	29,624	971	61.6
1952	1,676	30,891	982	62.8
1953	1,712	31,923	1,000	63.1
1954	1,766	32,864	975	64.8
1955	1,926	34,765	972	66.4
1956	2,002	35,990	958	68.0
1957	2,124	37,018	929	69.6
1958	2,150	36,283	859	71.7
1959	2,224	36,915	835	72.7

into operation two new waste water disposal systems late last year which give a good picture of how such facilities work.

The 157 members of Oil Operators, Inc., started up a $1-million plant at Long Beach which treats around 100,000 bbl. of water daily from wells and refineries in the Signal Hill area.

Main parts of the plant include two 750-bbl. separation tanks, five 90-ft. diameter clarifier basins, an aeration tower and three flotation cells. Waste water spends about 11½ hours in the plant before it is turned into a pipeline running to a point of high tide in the nearby ocean.

After treatment the water contains, on an average, 4 ppm. of oil, 6.2 ppm. oxygen, a pH of 7.2 and no measurable sulfides and dissolved sulfides. Operating costs were running around $0.0061 per barrel.

The other big waste-water plant opened last year is the $475,000 Santa Clara Waste Water Co. pipeline system in the Saticoy-Santa Paula area.

The main feature of this setup is a 12-mile, 10-in. pipeline which transports the treated waste waters to the city of Oxnard where it is discharged into that city's industrial waste line which, in turn, empties into the ocean.

The three companies operating the line, Shell Oil Co., Superior Oil Co. and Mobil Oil Co., paid Oxnard $25,000 for the license agreement to discharge into the city's facilities. In addition, the users of the line pay about $800 a month to the city. The line and skimming ponds will handle about 6,000 bbl. of water daily.

Waste water from the Saticoy field formerly was trucked away or reinjected.

New 60,000-Psi. Pipe Welds Easily

• High strength, welding ease, even below zero, obtained with columbium.

A NEW high-strength steel line pipe which retains ease of welding has been announced by Great Lakes Steel division of National Steel Corp.

The new line pipe is available in minimum yield strengths of 45,000, 50,000, 55,000, and 60,000 psi. Higher yields are obtained from the use of minute quantities of columbium rather than increased amounts of carbon and manganese as in standard line-pipe steels available through 56,000 psi.

More than 100 pipeliners witnessed tests of the new "GLX-W" pipe at the Baton Rouge, La., plant of Cal-Metal Pipe Corp., which will fabricate the pipe from plate made by Great Lakes.

Several advantages are claimed for the new pipe without the problems usually associated with conventional steels:

... **Welding ease,** even at subzero temperatures, with no preheating as is normally required with high-strength steels as temperatures approach freezing; hence, construction costs should be lower. Pipe was welded in the test at −52° F.

... **Fewer defective welds,** and therefore fewer costly cutouts and repairs, because of good welding qualities.

... **Ease of lineup and bending** in construction.

Five miles of columbium line pipe was installed last September for Houston Natural Gas Co. near Beaumont. The 24-in. line was of 45,000-psi. steel. Great Lakes quotes the contractor, Houston Contracting Co., as saying welding costs of the new pipe under normal conditions might be 10 to 15% less than with existing steels.

"The welding savings could amount to an additional $500 per mile in cold weather," if preheating and controlled cooling are not required, according to H. J. Muckley, vice president of Houston Contracting.

PIPELINERS had some penetrating questions to ask about the weld strength of Great Lake Steel's new GLX-W pipe during a demonstration last week. The pipe maker says crush tests show the weldment area is stronger than the parent metal, which showed yield of 62,500 psi.

Columbium steel . . . Columbium steels have been around for some time, but Great Lakes approach has been with semikilled instead of the costly killed steels.

The cost of columbium, once an obstacle, is no longer a problem since the discovery of large deposits in Quebec and resulting lower prices. Africa was a previous source.

Columbium increases tensile properties, lowers temperature toughness, and doesn't affect ductility, Great Lakes reports. Typical analysis of the GLX-W steel is carbon 0.16%, sulfur 0.018%, silicon 0.05%, manganese 0.75%, phosphorous 0.009%, and columbium 0.01 to 0.04%.

Industry reaction . . . Pipeliners interviewed by the Journal were impressed with the tests and thought the pipe had "definite possibilities."

They were interested in a line pipe that would give them more capacity per dollar spent for steel and installation. And so the big question in their mind was: "Can we save any money?"

The pipe maker said there would be a premium for columbium steel as there is for higher tensile pipe now in use, but "how much we don't know yet."

Northwest Territories Wildcat Hits Gas

- Well flows 6,000 M.c.f. daily. Home Oil's find is first on Canadian spread.

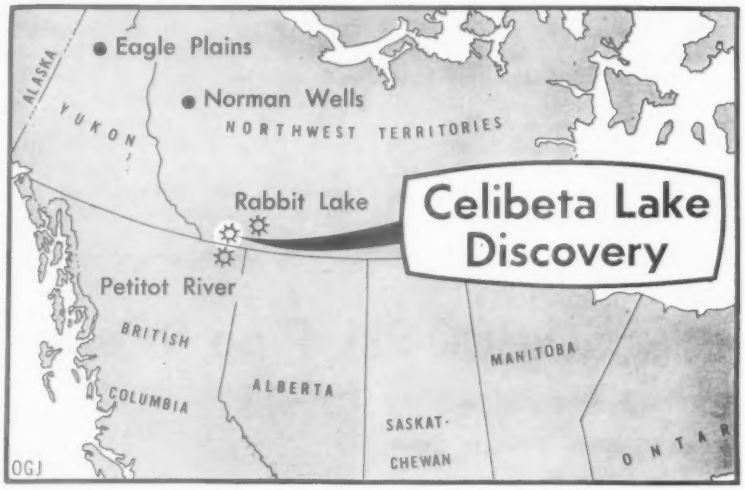
FIRST DISCOVERY of the year for Canada's Northwest Territories is reported at Celibeta Lake, 30 miles northwest of the Petitot River gas field in British Columbia.

The well flowed 6,000 M.c.f. daily from the Slave Point Devonian at 3,745 to 3,765 ft. It is a joint venture of Home Oil Co., Signal Oil & Gas Co., Kern County Land Co., Alminex, and United Oils, Ltd. The Celibeta Lake 2 is 8 miles north of the Northwest Territories-British Columbia boundary and 8 miles west of the Simpson trail.

It opens the third producing area in N.W.T., and the fourth in the entire near-arctic regions of Canada. There is production at Norman Wells and Rabbit Lake, and at Eagle Plains in Yukon.

The well is located on a spread of 1,224,000 acres farmed out from Canada Southern, Ltd., to the Home group. The group agreed to pay $3,500,000 in cash and spend $3,000,000 additional over 5 years to earn a one-half interest.

An option on an additional 31,966 acres on the southern edge of the spread also was acquired.



Home is operator of the projects and will earn a 12.5% interest. Signal will have 25%, Kern County and Alminex 5% each, and United 2.5%. Canada Southern will have a 37.5% interest and Magellan and Oil Investments each 6.25%.

Will Humble's 50-State Brand Debut in Ohio

HUMBLE OIL & Refining Co. is still keeping under wraps its plans for a nationwide brand name to use in marketing its products. But perhaps not for long.

The company is now invading Ohio where, by court order, it cannot use the Esso brand name. The name it does select for the new territory may well furnish a clue on the 50-state name Humble will establish for its service station products.

Humble President Morgan J. Davis said a program for developing and building service stations in Ohio is starting this month with headquarters in Columbus and sales district offices in Cleveland and Zanesville.

For competitive reasons the company is not disclosing details of the program, such as the brand name, the number of stations to be started, or how they will be acquired. Many, or all, of the stations will be constructed anew, although this does not rule out purchase of stations owned by others.

Humble officials have acknowledged they are studying the brand name problem.

The company is limited on the number of states which can use Esso. The Humble and Carter names are used in some states.

Standard Oil Co. (N.J.) recently combined its domestic operations into the single Delaware-incorporated Humble Oil & Refining Co.

Heading the new Ohio marketing division is James T. Outz, former special assistant to the general manager of marketing of Humble's Esso Standard Division. Wesley B. Cooper, former manager of the Washington, D. C., district for the Esso Standard sales division, is the new sales and operations manager for Ohio.

Humble's refinery at Baton Rouge, La., will furnish products for the Ohio division. Eastern Ohio will be the principal target for the beginning of the marketing campaign because that section can be supplied more easily from Humble's present Ohio River barge terminals.

Davis said it may be more than a year before a substantial number of newly-built stations are operating.

Kentucky's Oil Law Effective in June

KENTUCKY'S new oil and gas conservation law, passed by the last legislature, has been signed by Governor Bert Coombs. It becomes effective the middle of June, 90 days from the March 19 legislative adjournment.

It provides:

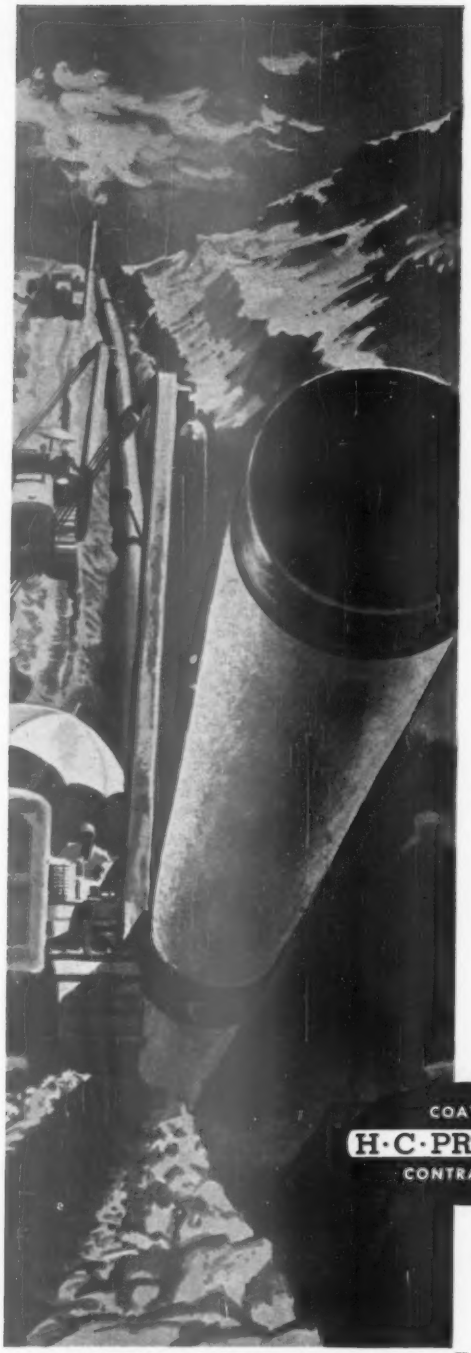
No oil wells may be drilled within 200 ft. of a property line or 400 ft. of another well producing from the same strata.

No gas wells may be drilled within 500 ft. of a property line or 1,000 ft. from another well producing from the same formation.

Drilling permits are mandatory before drilling begins. A provision is included for pooling agreements when land conditions make it impossible to meet the property line and nearest producing well requirements.

All geological information or logs obtained from drilling operations must be filed with the Department of Mines and Minerals and the information will be available to any operator interested (OGJ, Jan. 11, p. 59).

A new post of director of oil and gas also was created.



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New Miscible Method Due Tryout in Texas

• Humble plans simultaneous injection of gas and water in one Seeligson field sand, hoping to minimize channeling and to triple recovery.

HUMBLE OIL & Refining Co. plans to start up this spring a new type of miscible oil-recovery method which it hopes will minimize the channeling and fingering problems operators have had with earlier miscible drives.

The company is awaiting the go-ahead from the Texas Railroad Commission to try out the method in the 21-A pay sand in Seeligson field.

Plans are to inject water and enriched gas simultaneously. The theory is that the water will interfere with the enriched-gas flow through the reservoir, improving the mobility ratio and thus the areal sweep efficiency.

Ed C. Barfield, Humble engineer, says the company hopes to avoid the "streaking" or channeling effect which occurs where water and gas slugs are injected alternately following the initial slug of LPG. The only known project using gas and water after the LPG is that conducted by Atlantic Refining Co. under its Boyd lease in Slaughter field of West Texas.

The Atlantic project also envisions that injection of water would improve mobility and hike the total recovery.

Plans and expectations . . . Humble plans initially to inject water and enriched gas simultaneously in its No. C-171 and dry gas in its No. C-7C.

The C-171 will take an enriched gas water mix of equal proportions by reservoir volume, with the enriched gas made up initially of 30% propane and 70% dry gas. Later on, probably in August, the enriched gas portion will be 50% ethane and 50% dry gas. The switch will be made, Barfield says, as soon as an adequate supply of ethane is available.

Humble engineers estimate that the 21-A sand will give up only about 25% of the oil originally in place via primary recovery operations.

They estimate the enriched gas-water drive will hike total ultimate recovery to more than 75% of in-place oil.

The 21-A pool is a small strand-line sand underlying portions of Seeligson and Tijerina-Canales-Blucher fields. It was discovered in April 1947. And it has produced roughly 330,000 bbl. of oil. Reservoir drive is predominantly dissolved gas.

There are now 11 wells producing from a pay averaging about 5-ft. in thickness. They produce a total of about 745 bbl. a day with an average g.o.r. of 1,700:1. Reservoir pressure had fallen from the original 3,650 psi. to about 3,000 psi. as of mid-1959.

Along with approval of the project, Humble asked for permission to:

. . . **Transfer** three wells completed in the sand to the Seeligson Zone 21-A field from Tijerina-Canales-Blucher field (Humble's King Ranch Tijerina J-82T, J-83T, and J-92T).

. . . **Inject dry gas** or water and enriched gas through added input wells subject to commission approval.

. . . **Operate the project** under a lease allowable, based on 1947 yardstick rates for the depth, of 121 bbl. per well per day, subject to shutdown days.

Producing wells slated for conversion to input service would be tested prior to the conversion for inclusion in the lease allowable.

INDUSTRY BRIEFS . . .

The purchase of wells in the Edison and Santa Maria areas of California for $400,000 has been made by Producing Properties, Inc., Dallas. The company bought 32 wells on 14 leases from Macson Oil Co., Los Angeles, with net production of 255 bbl. of oil a day. Producing Properties estimates the reserves acquired at 750,000 bbl.

Oklahoma's oil allowable in April has been set at about 527,000 bbl. daily, the same as for March, based on a per well figure of 18 bbl. daily. Ray C. Jones, chairman of the Oklahoma Corporation Commission, said another hearing will be held April 12 for a "second look" at the April figure.

Siboney-Caribbean Petroleum Co., Tulsa, purchased Bitucote Products Co., St. Louis. Bitucote operates seven plants and in 1959 sold 25.8 million gallons of asphalt emulsions for highway and street construction. Siboney stockholders will vote April 21 on proposed issuance of one million shares of $10 par value stock. The money would be used to acquire oil and gas properties.

Approval of the Texas Railroad Commission has been asked for a unitization and water-flood program for Sweetwater (Canyon) field in Fisher and Nolan counties, West Texas, by Sinclair Oil & Gas Co. An estimated 2,055,700 bbl. of additional crude would be recovered from the 2,500-acre unit. There are 48 producing wells in the project area and cumulative production is 1,690,000 bbl.

Properties of Texas-Alberta Oil Corp. in the eastern Midland County sector of the Spraberry Trend area field in West Texas have been purchased by William G. Ross, Midland oil operator. Included are 41 wells on nine leases covering 2,755 acres. Fourteen wells are producing an average of 175 bbl. a day, and the remainder are shut-in.

El Paso Natural has paid Slick Oil Corp. $2,750,000 for its mineral interests in 8,887 acres on the Chapa ranch, Live Oak County; 10,475 acres on the Baker ranch in McMullen and Live Oak counties; and 20,701 acres on the LaPerla ranch in Zapata County, Texas. Sid Katz, San Antonio, has completed a gas discovery on the Chapa ranch. A second well is drilling.

Shell Oil Co. will close its Grand Junction, Colo., exploration office about June 1. Most of the 13 employes will move to Shell offices at Casper, Wyo. T. L. Kirby, district geologist, said exploratory work now handled through Grand Junction is in northwest Colorado and southwest Wyoming and can be directed effectively from Casper.

Luling area independent producers have organized the Central Texas Oil and Gas Association, Inc., to promote their interest in central Texas. Six directors have been named as incorporators. They will meet this week to draft by-laws to present to a membership meeting April 12 at Luling Country Club. Gaines R. Whittington, Luling, is the temporary secretary and a director.

Providence Petroleum Corp., Houston, a producing company, has changed its name to Propetco, Inc. Charles H. Cutler is president.

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Bankers Still Want "Good" Oil Loans

• But it's getting tougher to qualify a deal as "good." Low allowables, increased costs, nervous crude prices, and government harassment combine to make bankers a bit wary of extending credit, John Scott tells North Texans.

A GOOD OIL loan is still very desirable business for a bank, but it's probably going to be harder for a deal to be classed in the "good" category.

However, there is no better investment than natural gas, especially if its production and sale are intrastate and not under the jurisdiction of the Federal Power Commission.

This current view of oil financing was given at the North Texas Oil & Gas Association annual meeting by John R. Scott, senior vice president of the Republic National Bank of Dallas.

Scott also made these predictions:

. . . **Domestic production** rates this year should not change much from 1959.

. . . **Drilling of marginal** wells, other than the most shallow ones, will present fiscal problems to most operators and companies.

. . . **Market competition** will be more than keen and price wars "will be much in evidence" in the products and international crude markets.

Problems now confronting the producer and his banker have become more numerous and complex, Scott said. These conditions and expectations for the future must temper the general policy of lending on oil.

Some of the factors to be considered are: The importation of foreign crude, the price of crude, the allowables, inventories, the cost of drilling and operating, and harassment by governmental authorities.

John R. Scott
. . . no better investment than gas.

Crude prices, he pointed out, have a better chance this year of going down than up. And the price of a lot of crude has been adversely affected by trucking and gathering charges.

Scott said the international economists who foresee the coming of the finest years of the industry in the next 3 to 5 years ignore two most salient factors—the discovery of new reserves and the possibility of international complications and politics.

In the past few years, the character of oil loans has changed, the banker said. Recently 80-90% of all oil loans have been made in connection with the sale of properties, which means that many of the independent producers have been selling their properties.

Compared to 10 or 12 years ago, loans for drilling and development represent a small segment of oil lending today.

Speaking of the profit in purchasing an oil or gas property, Scott said such a gain is largely measured by the income tax saving a bank, together with a good tax man, can create or generate.

This circumstance will continue for many years to come, he said. And these tax-saving methods have had almost as much bearing on the increase of property values since 1946 as the rises in the price of crude since the same date.

Spraberry Flood Waiting for Go-Ahead

• Southland estimates flooding big Aldwell Unit would recover an additional 19 million barrels of crude.

SPRABERRY TREND Area field's first big water flood now is awaiting Texas Railroad Commission approval.

The 15,776-acre project is planned by the proposed Spraberry Aldwell Unit, with Southland Royalty Co. as unit operator.

Harold Harris, special projects engineer for Southland, told the commission at a hearing on the project earlier this month that the proposed program would cost roughly $3,000,000. And it would recover additional oil, operators think, valued conservatively at $60,000,000.

The project area now is definitely in the stripper stage of depletion. It has produced a cumulative 10,429,869 bbl., which operators estimate at less than 8% of the oil originally in place.

They figure that the area would produce only about 2,650,000 bbl. more oil under primary operation—and this only if every well were carried to an economic limit of 74 bbl. per month.

On the other hand, the planned flood would add 19,000,000 bbl. and boost the total take from the unit area to about 32,000,000 bbl.

Production in the unit area now is running about 70,000 bbl. a month, as compared to about 250,000 bbl. a month in mid-1955. And the area output now is from more wells.

Harris told the commission that 100% of the 55 working-interest owners in the unit area either have signed or committed themselves to sign the unit agreement. Nearly 98% of the royalty interests have signed or agreed to sign.

The Southland engineer said that flood plans call for 29 input wells. These would inject water from the San Andres formation first into the lower Spraberry and later into the upper zone.

Unit participation is based 60% on acreage and 40% on cumulative production per quarter section—the latter factor having an upper limit of 100,000 bbl.

Indiana Standard Tries to Cushion Layoffs

• Company is making an effort to place employes with other firms.

ATTEMPTS TO EASE the unpleasantness of layoffs at two refineries are being made by the management of Standard Oil Co. (Ind.).

At the refinery in Sugar Creek, Mo., and the Texas City plant of American Oil Co., a subsidiary of Standard, programs have been initiated to help those affected by the cutback.

The layoffs will be particularly hard on the workers because only recently they ended strikes called by the Oil, Chemical and Atomic Workers Union. The strike at Texas City lasted 6 months and the one at Sugar Creek, 241 days.

Approximately one-third of the operating and maintenance jobs at Sugar Creek have been eliminated and 90 employes at Texas City will be laid off April 15.

At Sugar Creek, refinery management:

... **Hopes to** make room for persons who want to return to work by offering early retirement for employes between 58 and 65 years of age.

... **Will make** relocation payments—ranging up to $5,000—to those who want to return to work but cannot be re-employed because of the lack of jobs.

... **Has engaged** an employment agency to find permanent jobs for those who are not rehired.

POSTING job opportunities on Amoco billboard is S. T. Crenshaw.

Amoco's effort . . . S. T. Crenshaw, employment superintendent at the plant, is spending full time on the job search. He is contacting prospective employers and advertising widely the availability of qualified workers.

In addition to the advertisements, the company has mailed letters to 500 employers in Texas asking for job leads. Each letter contained personal data sheets on the 90 men showing their industrial experience, ages, and family status.

Amoco's effort is something of a rerun of an earlier campaign for jobs when 144 men were laid off. At that time 100 men were placed in jobs satisfactory to them, and more than enough jobs were available to others who turned them down for various reasons.

An OCAW spokesman said the union is satisfied that the layoffs are being made in accordance with the new contract. "There is no reason to believe the company is acting in anything but good faith," he said. "Any company has a right to lay off men."

Amoco explained that 65 men in the nonlaborer group and 25 in the laborer group would have to be dismissed April 15 because of reduced refinery runs and automation.

In the employe newspaper, the Amoco Texan, the company explained where the cutbacks would occur in the plant. The maintenance backlog has been virtually eliminated, and some craft groups have essentially no backlog. The same holds true for the labor force. Also, construction work is at an all-time low since completion of coker outside-battery-limits facilities.

One thing which may soften the blow is early retirement of older employes. The company has offered retirement to men between 60 and 65 years of age, and the layoffs will be reduced by the number of men taking retirement.

PROCESSING BRIEFS . . .

Bay Petroleum Co.'s name has been changed to Tennessee Oil Refining Co. It remains as one of four divisions of Tennessee Gas Transmission Co. and will continue to operate refineries, gas-processing plants, and product marketing in 23 Rocky Mountain, southern, and eastern states. The company will continue to market under the brand name "Bay."

American Chemical Corp., jointly owned by Richfield Oil and Stauffer Chemical, has brought on stream a new $7-million plant at Long Beach, Calif., for the manufacture of high quality ethyl chloride, vinyl chloride, and ethylene dichloride.

Continental Oil Co. has introduced a third grade gasoline with 101.5 Research octane rating in Kansas, Missouri, Nebraska, and Iowa. The "Conoco Super Premium" is the first for Continental since a test 2 years ago of a third grade at 24 Houston stations. Continental may expand third-grade sales into a wider area if the four-state program is successful.

A new gasoline is being introduced by Sun Oil Co. to replace the basic fuel it has been using in its 6-grade custom-blending system. It is called Sunoco Blend 200X and sells at regular-grade prices.

Two new processing units, a 3,000-bbl. Platformer and a 6,000-bbl. distillate Unifiner, will be erected by Procon (Canada), Ltd., Toronto, at Consumer's Co-Operative refinery, Regina, Sask. Completion is scheduled for December 31, 1960.

Texas Discovery Claim Will Need More Proof

THE TEXAS Railroad Commission has molded a stringent new yardstick for determining what is and what is not a discovery well in Texas.

Under Texas' regulatory setup, wells in a new field are given an incentive "discovery" allowable which is well above the conventional depth-yardstick rate—especially at depths below 5,000 ft.

Wells drilled in the new field keep this higher allowable for 18 months from completion of the discovery well, or until the sixth well is completed in the field—whichever occurs first.

Formerly, mere horizontal distance from an existing field was sufficient to qualify for a discovery allowable.

Now, the commission has put operators on notice that they must clearly show any alleged new reservoir is effectively separated from any older one in the area.

The new requirements . . . Here is what operators must submit with any application for a new field designation and discovery allowable.

. . . An area map (to a scale of 1 in. equals 1,000 ft.) with all oil, gas, and abandoned wells within a 2½-mile radius of the discovery. All nearby fields, past or present, must be identified clearly with the correct field names, producing formations, and average depth of producing intervals.

Total depth must be shown on all dry holes which are used as evidence of separation. Maps should be on white paper with all pertinent data shown.

. . . Complete electric log of the subject well with the formation and all nearby producing formations clearly identified.

. . . Subsurface contour map, contoured on top of the producing formation if the application is based on structural differences. This map must be signed by the engineer or geologist who prepared it.

. . . Geological cross-section prepared from electrical logs (not tracings of logs), if the application is based on faulting, pinchouts, or vertical separation of small magnitude.

. . . Reservoir pressure measurements or calculations other than drill-stem test pressures if the application is based on reservoir-pressure differentials.

. . . Detailed core data or drill-stem test data from comparable formations if the application is based on differences in fluid levels. Fluid-level data should be recent.

Finally, the commission requires that all offset operators be notified in writing that a discovery application is being made if the alleged new reservoir is on a known multipay structure.

Midland-Roswell Scouting Service Set

A COMMERCIAL scout check service will begin operation in Midland, Tex., and Roswell, N. M., June 1.

In another development, the Oklahoma advisory scout check committee is hearing proponents of commercial check services for Oklahoma, Kansas, North Arkansas, and the Texas Panhandle.

The Williams & Lee Scouting Service Corp. says 16 companies have contracted for Texas-New Mexico scout data. The service will cover areas now handled by the north-south Midland and southeastern New Mexico checks. (OGJ, Aug. 24, p. 47).

Eight scouts and a secretarial staff will headquarter in Midland. Three scouts and staff will be at Roswell. Charge for the Midland service is $950 a month and for Roswell $500.

Manager will be E. W. (Woody) Adams, until 2 years ago Gulf's chief scout in West Texas. C. B. Williams, Fort Worth, former Texaco division manager, and Lynn K. Lee, Fort Worth, former Pure exploration manager, and Adams, are owners.

First of the commercial-type checks was Well Record Service, Denver, which began operation last October offering scouting work in eight Rocky Mountain states. There are 16 companies in the Denver plan. (OGJ, Aug. 3, p. 44). Seven companies signed for the Midland-Roswell service are in the Denver setup.

Average gasoline quality throughout the country took its sharpest jump in a long time in March. Premium rose to 99.5 RON, up 0.2 and regular rose to 92.4, up 0.1, from the February averages. It was the first time since January of 1959 that premium rose as much as 0.2 of an octane in 1 month, according to Ethyl.

Even more impressive was the gain in motor octane number. Premium rose 0.4 in MON to 89.7 octane and regular, 0.3 to 84.5 octane, in March.

A $1,300,000 alkylation unit is to be constructed at United Refining Co.'s Warren, Pa., plant. A contract has been awarded M. W. Kellogg Co. Completion is expected in November.

Construction will start soon on the West Coast's first high abrasion carbon-black plant, Continental Carbon Co.'s $2.5-million installation at Bakersfield, Calif. Capacity will be 30 million pounds of carbon black a year. Owners of Continental Carbon are Continental Oil Co., Shamrock Oil & Gas Corp., and Witco Chemical Co., which will distribute the products.

Sunray Mid-Continent plans to expand the gas-handling capacity of its Criner plant, McClain County, Oklahoma, from 5,000 M.c.f. daily to approximately 30,000 M.c.f. daily. Completion is expected by early summer. Tuloma Builders, Tulsa, is handling the engineering work.

Continental Oil Co. will spend $2 million to increase the capacity of its Lake Charles, La., natural-gasoline plant from 100 million cubic feet of natural gas daily to 150 million. Work will start in June and be completed in January. Hudson Engineering Corp., Houston, has the construction contract.

Also for Refineries . . .

IN THE NEWS: Detroit is looking at ram induction (p. 65) . . . New reports from the annual WPRA meeting (pp. 66-67) . . . Indiana Standard hopes to find jobs for workers laid off at Sugar Creek and Texas City (p. 78).

PLUS THESE TECHNICAL REPORTS: Dow's new Saginaw Bay plant (p. 90) . . . Refinery cost indexes (p. 96) . . . Quarterly costimating report (p. 100) . . . Questions and Answers on Cat Cracking from the WPRA meeting in El Dorado (p. 102) . . . Putting linear programing to work (p. 114).

ENI Has Something to Crow About

• Italy's Mattei has been working long and hard to come up with production in the Middle East. He broke the 50-50 pattern to win a concession—and now he reportedly has a discovery in the first wildcat drilled off Iran.

ITALY'S Enrico Mattei at last may have a Middle East oil pool to call his own.

Rome last week buzzed with reports that the state-owned company headed by Mattei has made a discovery in the Persian Gulf off Iran.

Well-founded reports say the joint Italian-Iranian offshore wildcat tests 3,500 bbl. daily. Pay was struck at 2,300 meters, or about 7,550 ft.

This jibes with the latest National Iranian Oil Co. information on well depth. NIOC said the hole had reached 7,564 ft. and 7-in. casing placed at 7,455 ft. Plans were to keep on drilling after testing.

The well is about 6 miles off the coast of Iran on a concession at the head of the Persian Gulf. SIRIP, the operating company, is owned 50% by Mattei's ENI-AGIP and 50% by NIOC.

If the discovery pans out, it will mean the Persian Gulf is still living up to its advance billing as one of the world's most promising oil patches. It will also be one of the biggest hurdles crossed so far in Mattei's struggle to develop crude production for Italy in the Middle East.

ENI-AGIP moved into Iran 3 years ago after signing the first of the concession agreements to break the traditional 50-50 profit split.

The agreement made NIOC a full, but nonpaying partner in the operating company, Soc. Italo-Iraniana Dei Petroli (SIRIP). The Italians are putting up all the exploration money and have agreed to split any profits first with NIOC, and then again with the government.

This, in effect, will give Iran a 75-25 profit split.

The offshore wildcat is on a 2,160-sq.-mile concession at the head of the Persian Gulf. It is being drilled from a permanent platform in 18 ft. of water.

Two other concession tracts also are held by SIRIP. The largest is a 4,360-sq.-mile license in the Zagros Mountains, adjoining the consortium area of operations on the east. The first wildcat in the Zagros area is drilling with air at 3,006 ft. It is located on top of Mount Sequta at a height of 8,200 ft. above sea level. The site is about 160 miles southwest of Isfahan.

The third SIRIP tract is a 2,320-sq.-mile concession along the coast of southern Iran, extending into the Gulf of Oman.

New Pan Am well . . . Pan American International (Indiana Standard) plans to start its second wildcat in April on a 6,180-sq.-mile offshore concession adjoining SIRIP's concession to the south.

The new well will be located about 21 miles south of Kharg Island in 142 ft. of water. It will be drilled from a fixed platform with an assist from a McDermott tender-type barge.

The first test is drilling ahead at

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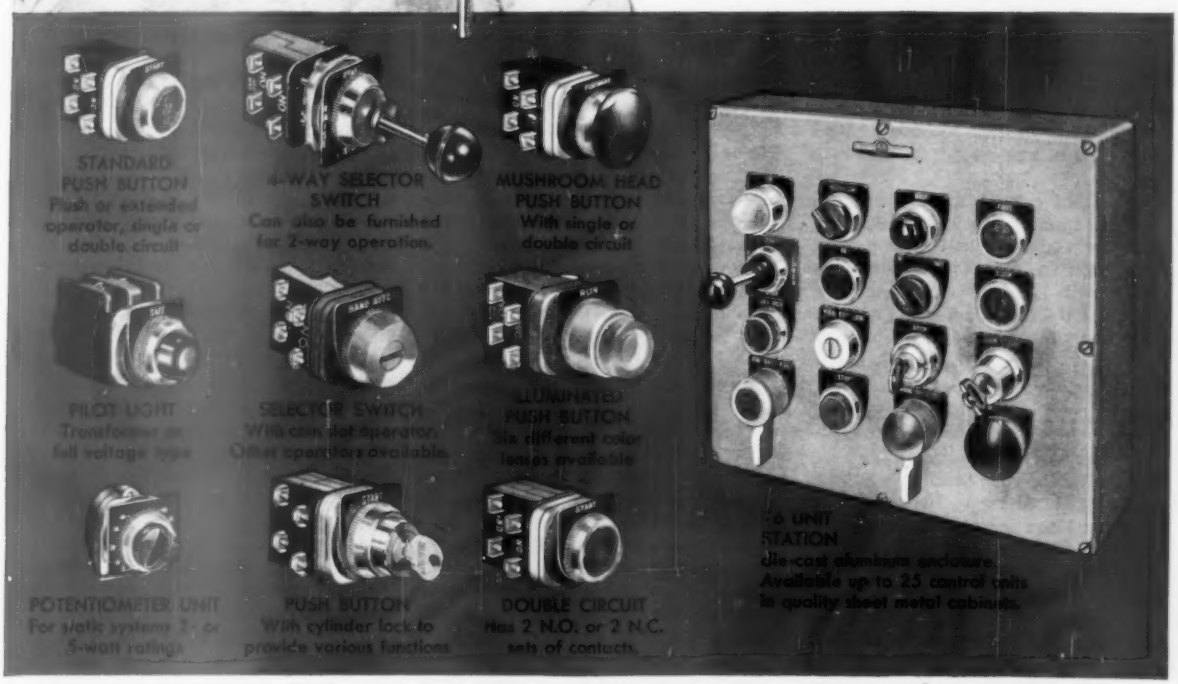
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11,633 ft. in the northwest corner of the block. Shows were encountered below 11,500 ft.

Pan Am's agreement with Iran is similar to the Italians. It will split profits with NIOC, and then again with the government. It also has a $25-million bonus invested in the rights and the company has promised to spend $82-million in exploration the first 12 years of its concession, acquired 2 years ago.

Pan American's Persian Gulf operations are being carried out through Iran Pan American Oil Co. (IPAC), a company jointly owned with the Iranian Government.

Other gulf production . . . The Japanese-owned Arabian Oil Co. is moving ahead rapidly with development of its discovery off the Neutral Zone. The first well came in earlier this year at better than 6,000 bbl. daily through a ¾-in. choke.

The first stepout is drilling ahead, and eight or nine more wells are planned by the end of the year. The Japanese concession terms with Saudi Arabia and Kuwait differ both from the standard 50-50 arrangement and from the ENI-type agreement.

The agreement calls for a 56-44 profit split with Saudi Arabia, and for a 57-43 split with Kuwait. The owner countries also will share in profits from transportation, refining, and marketing (OGJ, Mar. 7, p. 76).

One offshore field is already on commercial production in the Persian Gulf. This is Aramco's 9-year-old Safaniya field off Saudi Arabia, which last year was averaging better than 57,000 bbl. daily. Another offshore field, Manifa, south of Safaniya, is shut in.

Thick Pays Found in Paria

- Ohio Oil confirms two zones have been found above pay in Posa discovery. New discovery also indicated.

PARIA Operations, Inc., encountered two thick new oil sands in two directional wells drilled from a platform on the Venezuelan side of the Gulf of Paria.

Logs indicate the sands total about 140 ft. in the first directional well, and 250 ft. in the second. Neither of the pays was found in the 1958 discovery.

A test of one of the zones in the first directional well yielded 303 bbl. daily of 14.30-gravity crude. A 75-ft. section in the second directional well tested 1,116 bbl. daily.

Ohio Oil Co., which confirmed the existence of the new pays, gave no depth figures. Neither of the directional wells reached the oil zone found in the initial Posa wildcat. This tested at rates up 1,980 bbl. daily.

Discovery possible . . . A second discovery may be in the making on the 151,000-acre concession. A wildcat 1½ miles south of the Posa find has encountered what appear to be oil sands around 5,500 ft. The well is being deepened before testing. Ohio Oil and four partners paid about $100 million in bonuses for the acreage. Ohio, Texaco, and Continental Oil each hold a 25%. Cities Service has 16⅔%, and Richfield Oil 8⅓%.

Production Extended in Lake Maracaibo

A STEPOUT to the first discovery on Block 12 in Lake Maracaibo has confirmed the initial 5,000-bbl. daily find.

Venezuelan Sun Oil Co. says the completion of SLGX 12-4 as a producer confirms the SLGX 12-3. The two wells, both dual producers, each tests about 5,000 bbl. daily. The stepout is about 4,000 ft. due south of the first well.

Sun, with 23⅓% interest in the block, is operator. Its partners are Venezuelan Atlantic and Pan American Petroleum (Indiana Standard), each with 33⅓%, and Texaco, with 10%. The find gives Pan Am its first commercial production in Venezuela (OGJ, Dec. 12, p. 64).

Sun also has extended the proven production area on Block 1, adjoining Block 12 to the east, with the completion of SVS-39 as a dual producer testing 5,000 bbl. daily.

The SVS-39 lies about 2,000 ft. southwest of No. 38 and is the southernmost producer on the block. It is about 4 miles northwest of the Block 12 discovery well.

Sun is operator on Block 1, with 45% interest. Venezuelan Atlantic holds 45%, and Texaco, 10%.

Drillers Will

- Men like high pay, but trend of leaving families at home causes many to return before 2-year hitch is completed.

RECRUITING drillers to work in the desert sands of Libya, the steaming waters of the Persian Gulf, or the jungle wilds of Nigeria is the uneasy task of Houston's Jack Enen.

Enen has no trouble finding men who say they're willing to spend 2 years away from home and family. His problem is finding men who will do what they say.

Enen heads Enen Corp. Its principal function is to provide overseas personnel for International Drilling Co., N. V., and to expedite shipment of materials and rigs to IDC's operations in the Middle East, Africa, and Europe.

IDC, headquartered in The Hague, is the largest drilling contractor in the Middle East and North Africa today, and it must keep crews on hand for 16 rotary and five cable-tool rigs.

The company has more than 1,000 employes abroad, of whom some 800 are nationals. But the 200 key men—drillers and above—are Americans and Europeans, and most of the Americans were hired out of Houston.

When IDC was organized in 1955, the policy was to send families abroad with the workers, and today perhaps 60% of the personnel are still in this category. But the new men hired for duty with IDC crews must go it alone.

"We're disappointed in having to go to single status," Enen said. "A man is naturally more satisfied if he has his family with him."

It was pure economics that dictated the change.

"Bidding on contracts in Libya is becoming almost parallel to bidding stateside," Enen said.

By "single status" Enen does not mean unmarried men in particular. Good, stable single men are hard to find. And divorced men, particularly those recently divorced, are generally poor risks because of emotional strain and the desire to "get away from it all."

What he does want is a stable, capable man willing to spend 2 years away from his family and whose wife is willing to be separated that long to stabilize the family budget or send the children to college.

Go Abroad, But Many Won't Stay

HUSBAND and wife team, Jack and Mary Enen, want drillers who will stick with foreign duty.

It is customary for the wife, as well as the husband, to visit Enen at his office in the Tennessee building in Houston before the job applicant is signed for foreign duty.

Enen is careful to point out the hardships they can expect—both the husband abroad and the wife at home alone. It's better, he figures, to weed out the questionable ones in advance. The company cannot hold a man abroad if he wants to come home—and occasionally he does just that, at a considerable loss of investment for IDC.

The pay which IDC offers is, of course, the major incentive that brings 30 or 40 applications monthly into Enen's office. A man will earn an average of $850 monthly, tax-free, plus subsistence, if he stays the full 2 years to collect his bonus. In the states he would make perhaps $500 monthly, if lucky enough to work fulltime.

Normally, Enen sends only men of driller classification to IDC. Toolpushers and superintendents usually come from the drilling ranks already abroad. There are exceptions, of course, such as mud engineers, mechanics, and materials men.

Employment conditions currently are "fluid," and there are no openings. Conditions, of course, may change momentarily, but Enen will not have to advertise, as he once did, to fill any openings. His large file of applications will produce plenty of prospects.

Recently Enen has received many applications from Americans who have returned to the states from Venezuela because of uncertain employment there.

The woman's touch . . . Enen has an enthusiastic aide in his wife, Mary Enen, who serves as his "Dorothy Dix" for stateside families of men abroad.

When a wife calls up to complain that the paycheck is too small to make the house payments (husband has drawn too heavily on his account), or her husband won't write, or the children need their Daddy, it is Mrs. Enen's job to smooth the ruffled feelings and help work out the problem.

Even this hand-holding operation doesn't keep all IDC crewmen at their jobs for the full 2 years. The annual turnover runs to about 30%. This, however, is somewhat better than the normal turnover of 35% for the overseas industry in general.

In the field, the men usually work 3 weeks at the rig and have 1 week of leisure in a nearby city. In Libya, where IDC has seven rigs at work, the men usually are flown to Tripoli or Bengasi from the drillsite.

The company . . . IDC currently is operating 16 rotary drilling rigs in the Middle East, Africa, and Europe. Of these, 12 are owned by IDC and 4 are under labor contract from the producer. All but one is at work, and the idle rig, now in Kuwait, is expected to move shortly to a new job.

Seven of the 15 active operations are in Libya—six for Oasis and one for Amoseas. Three are in Iran for the consortium and two in Nigeria for Shell-British Petroleum. IDC also has one rig running in Somaliland for Sinclair, one off the Neutral Zone for the Japanese-owned Arabian Oil Co., and one in The Netherlands for N. V. Nederlandse Aardolie Mij. (NAM).

IDC is a Dutch company owned by two Americans, Wallace W. March and Monty Garrison. Both formerly were with Drilling & Exploration, Inc., Dallas, and in 1955 launched their own company.

They pioneered contract drilling in the Eastern Hemisphere and today are cashing in on the new activity in North Africa and elsewhere in that part of the world.

Right now they're taking a hard look at the Spanish Sahara, where new concession awards recently have been announced.

It may be that Jack Enen soon will be sifting through his large batch of applications for likely prospects who will swallow a dose of desert life for extra good pay and a steady job.

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- Free-world oil, outside U. S., tops 10 million barrels daily. Saudi Arabia, Canada lead the way.

CRUDE-PRODUCING areas of the free world outside the United States topped the 10-million-barrel-daily level for the first time in history in January.

The record was due largely to an all-time high in the Middle East, where the 5-million-barrel-daily mark was reached for the first time. Saudi Arabian output was higher than ever before at 1,221,200 bbl. daily, while Kuwait, Iran, and Iraq were at near-record levels.

Canadian operators enjoyed a record production of more than 600,000 bbl. daily for the first time, while companies in Venezuela had the highest level in 10 months.

Output in Algeria went up another notch to 110,900 bbl. daily. Colombia output also was at a record high, after inching upward to 156,900 bbl. daily.

TREND OVER LAST YEAR

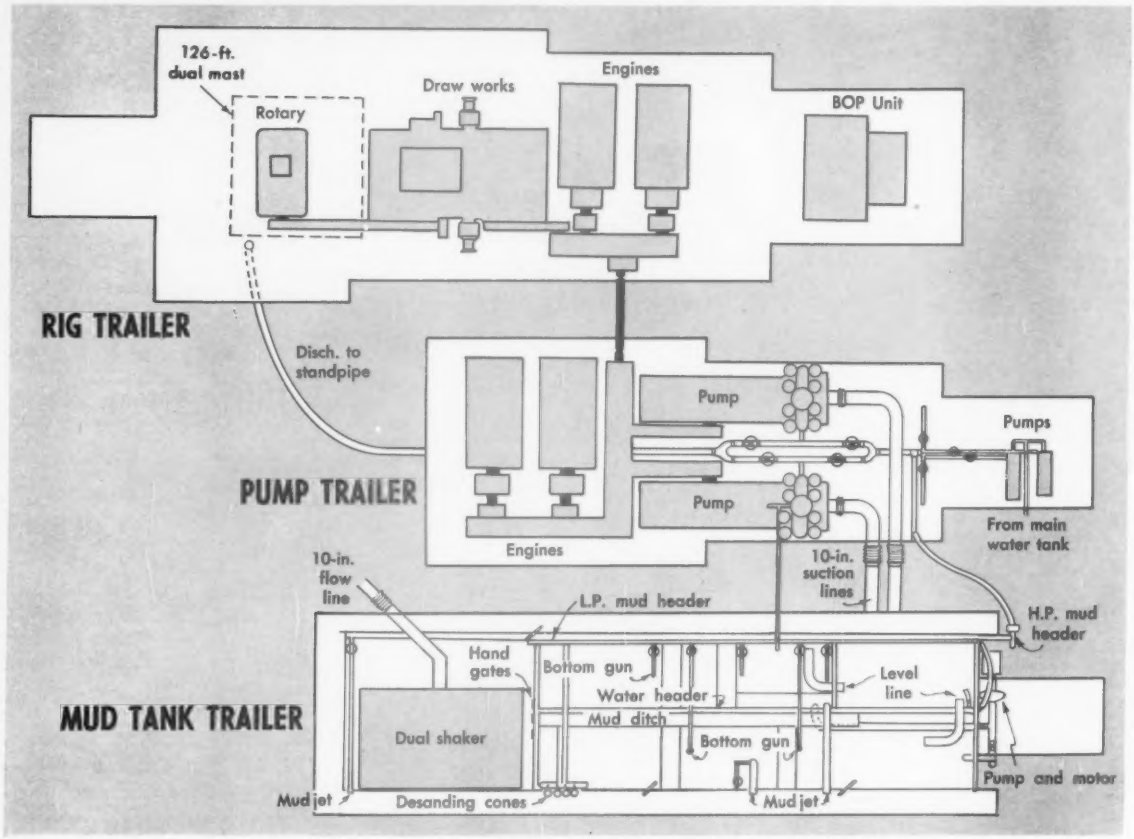
	Western Hemisphere less U.S.	Middle East	Total free world outside U.S.
1959			
January	4,281.1	4,371.4	9,422.6
February	4,453.9	4,426.1	9,649.7
March	4,220.6	4,634.2	9,680.7
April	3,910.4	4,646.4	9,396.5
May	3,773.6	4,571.4	9,181.0
June	4,111.5	4,467.9	9,428.7
July	3,914.8	4,532.5	9,293.2
August	3,862.1	4,659.7	9,344.9
September	3,887.5	4,635.5	9,396.4
October	4,069.6	4,688.2	9,629.8
November	4,123.2	4,820.7	9,877.9
December	4,218.5	4,682.0	9,861.5
1960			
January	4,315.5	5,065.4	10,334.0

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	Jan. 1960	Dec. 1959	Jan. 1959
Western Hemisphere			
Argentina	135.9	135.9	110.4
Bolivia	9.1	9.1	7.6
Brazil	76.0	76.0	34.6
Canada	605.0	527.0	545.6
Chile	18.8	18.8	16.0
Colombia	156.9	153.4	138.9
Cuba	0.5	0.6	0.6
Ecuador	7.6	7.1	8.1
Mexico	265.0	265.0	267.2
Peru	47.2	47.2	49.3
Trinidad	114.8	115.8	108.0
Venezuela	2,878.7	2,862.6	2,994.8
Total	4,315.5	4,218.5	4,281.1
Europe			
Austria	45.3	45.3	48.9
France	35.8	36.4	27.6
West Germany	102.2	101.8	90.6
Italy	29.0	37.3	15.6
Netherlands	33.3	33.7	34.4
United Kingdom	1.7	1.7	1.6
Yugoslavia	12.0	12.9	9.4
Total	259.3	269.1	228.1
Middle East			
Bahrain	45.1	45.0	45.5
Iran*	999.0	939.0	834.0
Iraq†	903.2	901.5	809.9
Israel	2.0	2.0	2.0
Kuwait	1,583.4	1,302.5	1,404.2
Neutral Zone	122.0	122.0	107.8
Qatar	182.6	153.5	167.0
Saudi Arabia	1,221.2	1,209.6	994.0
Turkey	6.9	6.9	7.0
Total	5,065.4	4,682.0	4,371.4

Country—	Jan. 1960	Dec. 1959	Jan. 1959
Other Asia			
British Borneo	110.0	110.0	107.0
Burma	10.5	10.5	9.4
India	8.5	8.5	9.0
Indonesia	335.0	350.0	300.0
Japan	9.0	8.7	7.0
New Guinea	4.5	4.5	5.0
Pakistan	5.9	5.9	5.9
Total	483.4	498.1	443.3
Africa			
Algeria	110.9	93.2	14.3
Angola	0.9	0.9	0.8
Egypt	59.5	61.4	63.8
Gabon	14.9	14.1	11.6
Morocco	2.2	2.2	1.5
Nigeria	22.0	22.0	6.7
Total	210.4	193.8	98.7
Free World			
Foreign	10,334.0	9,861.5	9,422.6
United States	7,230.0	7,193.0	7,223.0
Total	17,564.0	17,054.5	16,645.6
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	235.0
Russia	2,688.0	2,688.0	2,420.0
Others	100.0	100.0	60.0
Total	3,023.0	3,023.0	2,715.0
WORLD TOTAL	**20,587.0**	**20,077.5**	**19,360.6**

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimates 6,000 bbl. daily from Naft-i-Shah field not operated by Consortium companies. †Includes estimates 3,300 bbl. daily from Naft Khaneh field, operated by Iraq Government.



DETAILED EQUIPMENT LAYOUT of International Drilling Co.'s new rig 15 designed for work in the North African desert. Fig. 1.

IDC's desert rig is model of mobility and

A VIRTUE has been made of adversity by International Drilling Co., The Hague, in assembling its new Rig 15.

Rig 15 was purchased to work in the remoteness of the North African desert where highways simply don't exist. Lack of highways complicates logistics, of course, but it also means there are no highway-weight limitations on the rig. Thus, there's no artificial lid on the size of units into which rig machinery may be packaged.

International Drilling made the most of this fact by assembling the bulk of Rig 15's equipment onto six big wheel-mounted packages. Table 1 shows how those packages weigh in.

Moreover, Rig 15's design makes it fast and easy to get these huge packages out of and back into operation during moves.

Look at Fig. 4 which shows the pump trailer in working position. Notice that the trailer bed rests flat on the ground. Thus, the unit does not tend to shake and vibrate when the pumps are running as it might if the trailer were supported by jacks or the like.

Now, look at Fig. 5 which shows the pump trailer ready for moving. Notice that the trailer bed raises clear of the ground when the moving truck engages the king pin up front. At the special goose-neck-king pin elevation of 79-in. (20-in. higher than U. D. standard), the trailer bed clears the ground by 18 in., the same distance as the bogey axles.

When the pumps are working and the trailer lies flat, there is no load on the trailer tires other than their own weight.

TABLE 1—HOW RIG IS PACKAGED FOR TRAVEL

Unit	Equipment included—	Weight in pounds— On king pin	On tandem
Draw works	Rig, two engines, compound, b.o.p. accumulator	32,500	93,440
Pump	Two engines, compound, two mud pumps, suction piping, two washdown pumps	50,000	112,000
Mast	126-ft. dual mast	32,500	58,227
Substructure	Rotary, mast substructure, dog house	30,000	33,483
Mud tank	Compartmented mud tank, dual shale shaker, desander, mud ditch, mud guns, mixing pump	25,000	35,000
Utility	Enclosed trailer with light plant, work area, storage space	30,000	57,000

NEW DESERT RIG in working position. All equipment visible here is wheel-mounted onto five units. A sixth wheel-mounted enclosed trailer holds auxiliary equipment. Fig. 2.

packaging

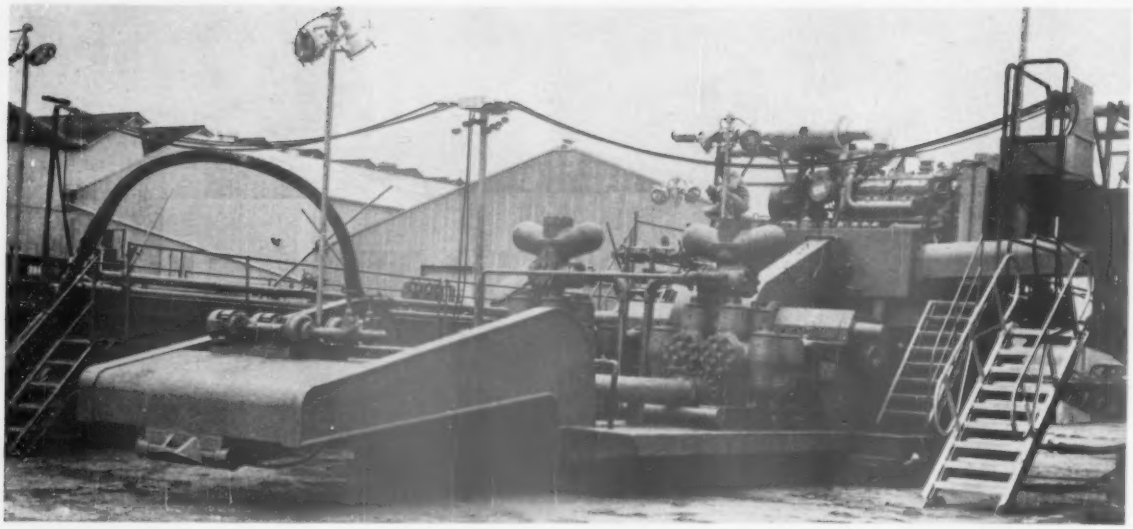
BY ED McGHEE
Drilling Editor

Fig. 6 shows the tires supporting the mud tank for a move. Notice the hinge pins at the top of the wheel structure. Once on location two lower pins are removed and the entire wheel structure swings about the upper hinges, lowering the mud tanks to the ground. Fig. 7 shows the mud-tank wheels in this disengaged position; the lower pins are visible under the bogey axle.

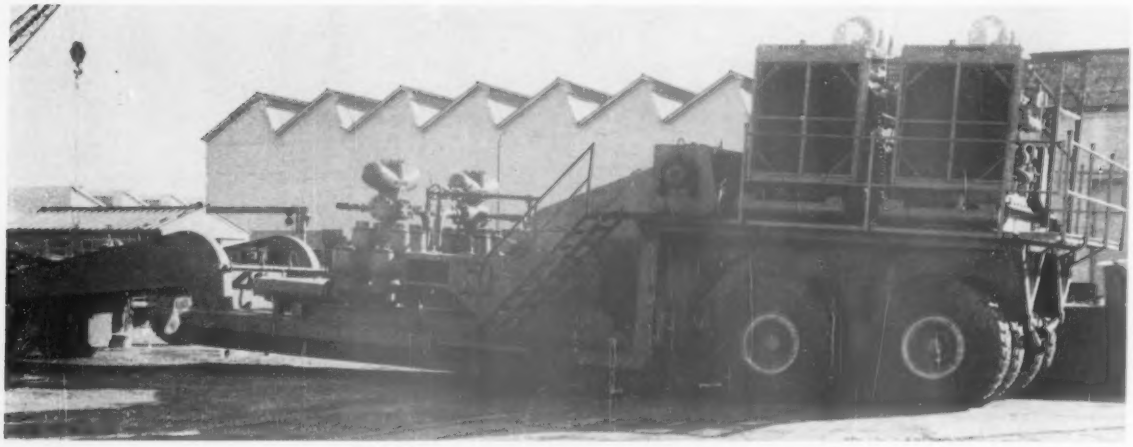
Preparing to move the mud tank after completing a well is a simple reversal of the above procedure. A gin-pole truck picks up the rear end of the mud tank and the two lower pins are quickly reinserted.

Substructure is trailer. The wheels visible in Fig. 3 are part of the trailer

DERRICK-FLOOR VIEW of rig. The mast trailer rides the wheels visible in the foreground; the mast itself was not in place when this photo was taken. Wheel ramps for mast and for draw-works trailer are only major pieces not wheel-mounted. Fig. 3.



PUMP TRAILER READY FOR WORK Notice that trailer bed lies flat on the ground so that there is no vibration problem. Wheels (at the rear) support only their own weight with trailer in this position. Fig. 4.



. . . AND READY FOR MOVING When trailer bed is picked up by moving truck, the bed clears the ground and is wheeled into the rear. Ground clearance is 13 in. Fig. 5.

unit which carries the 126-ft. Lee C. Moore dual mast. The mast was not in place at the time of this photo. Although there is little outward evidence of it in Fig. 3, the mast substructure in that photo is also a wheel-mounted package. The dog house visible in the photograph is sitting over what is actually the gooseneck of the trailer. The wheels are pinned to the opposite end of the substructure package in the same manner as on the mud-tank trailer.

The rotary table is part of this substructure package rather than of the draw-works package.

Also visible in Fig. 3 are the only two large pieces of equipment on the rig which are not wheel mounted. These are the ramps upon which the draw-works trailer and mast trailer are run to elevate them to derrick-floor height. Of course, these ramps are not large enough for separate wheel mounting. So, they are carried separately during moves.

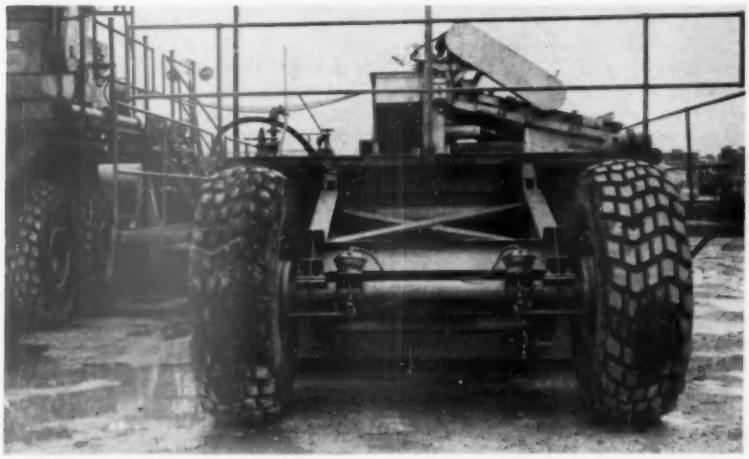
Flexible power. International Drilling has added further to the flexibility of Rig 15 by connecting draw-works trailer to pump trailer with a torque-tube drive. Thus, the two engines on the pump trailer can, by driving through the torque tube, assist the two engines on the draw-works trailer in powering the National T-45 rig. Or, conversely, one or both the draw-works engines can help in driving the two National K-500 pumps.

It simplifies replacement and maintenance problems that all four of the engines mentioned are identical—Caterpillar D375-DT's. These are normally diesel fueled but can be adapted to burn field crude. This fuel flexibility will be quite important in the Sahara where delivered cost of diesel oil can be in excess of $1 per gallon.

Each of the engines is fitted with a National 239 torque converter with heat-exchanger cooling.

Compartmented mud tank. Rig 15's mud system is one of the simplest and

MUD TANK ROLLS on these wheels. Notice the hinge pins at the top of the wheel structure; there is a similar pair of pins at the bottom of this structure. Thus, the wheels are quickly attached or removed. Fig. 6.



WITH LOWER PINS REMOVED, mud-tank wheels roll out, lowering the mud tank flat on the ground. A similar wheel-mounting structure is attached to the mast substructure so that it, too, is a trailer unit. Fig. 7.

most compact yet assembled. Instead of using two or three smaller tanks, Rig 15 has only one large tank and this one rolls on wheels. However, this tank's 50-ft. length, 12¾-ft. width, and 6-ft. height make it the equivalent in volume of almost three standard-size tanks.

Walls inside the tank divide it into settling compartment, suction compartment, and two storage compartments. A built-in mud ditch runs down the center of the tank from the shale shaker on one end to the suction compartment on the other.

The auxiliary equipment. A portion of Rig 15's auxiliary equipment is housed in the enclosed trailer pictured in Fig. 8. This is the sixth and last of the rig's major packages. In this unit are the twin engine-driven a.c. light plants, an air compressor, drill press, battery charger and other items. The trailer also has storage and work space.

Most auxiliary equipment, however, is included on the other five trailer units. For instance, the engine compound on both draw works and pump trailers has an air compressor for rig use. The pump trailer also carries two 2 by 3 centrifugal washdown pumps; these are visible atop the gooseneck in the foreground of Fig. 2.

The mud tank trailer carries a 5 by 6 centrifugal mud-mixing pump and its driving 25-hp. motor. This equipment is on the underside of the trailer's gooseneck. A dual shale shaker and a desander are mounted above the tank on the opposite end.

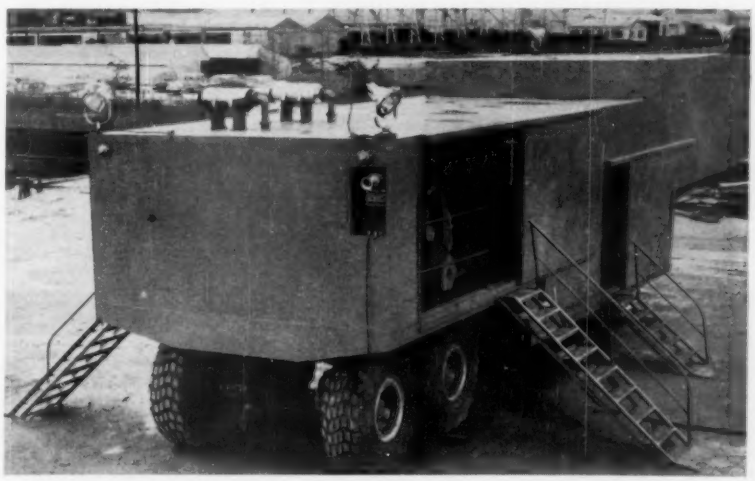
The draw-works trailer (on the end opposite the rig) carries a blowout-preventer accumulator unit.

Another feature of the rig is a high-temperature, low-oil-pressure alarm system for each of the three groups of engines. One of these alarm systems, that for the light-plant engines, is visible in Fig. 8. There are lights to indicate the nature of the trouble and an electric horn which may be heard all over the rig. In addition, there are switches at the driller's position which will shut down either the draw-works engines or the pump engines or both. Exhaust on the draw-works engines is both water-cooled and insulated; this is necessary because a canvas sun shelter is erected over the unit for the desert work.

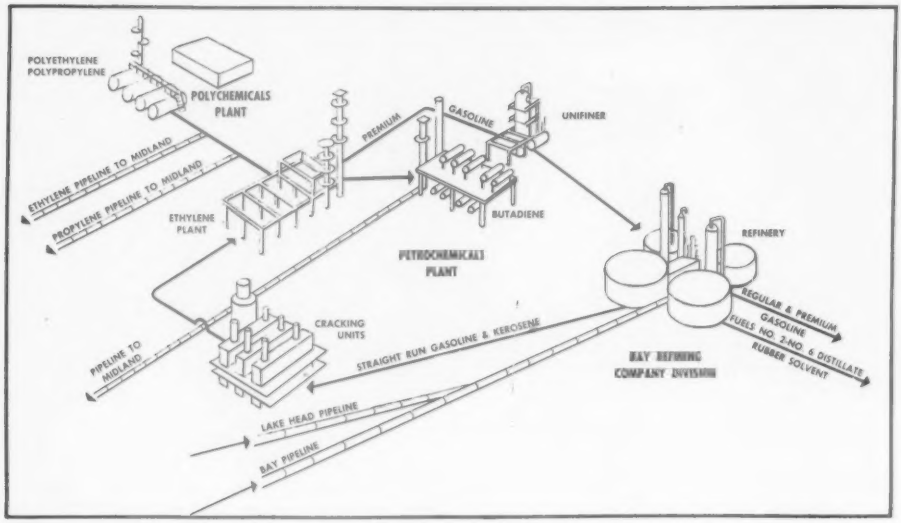
Tires used on the trailers are special desert type. They are only single ply, but use steel cords.

Acknowledgment

Thanks are due Jack Enen, adviser and consultant to International Drilling Co., Houston, and John Adcock, National Supply Co., Houston, for the contributions they made to the preparation of this article.



THIS WHEEL-MOUNTED TRAILER UNIT provides work and storage space as well as carrying the rig's light plant. Electric horn visible in recess above right rear wheels is part of a long system of light plant's engines. A similar system protects drawworks and pump engines. Fig. 8.

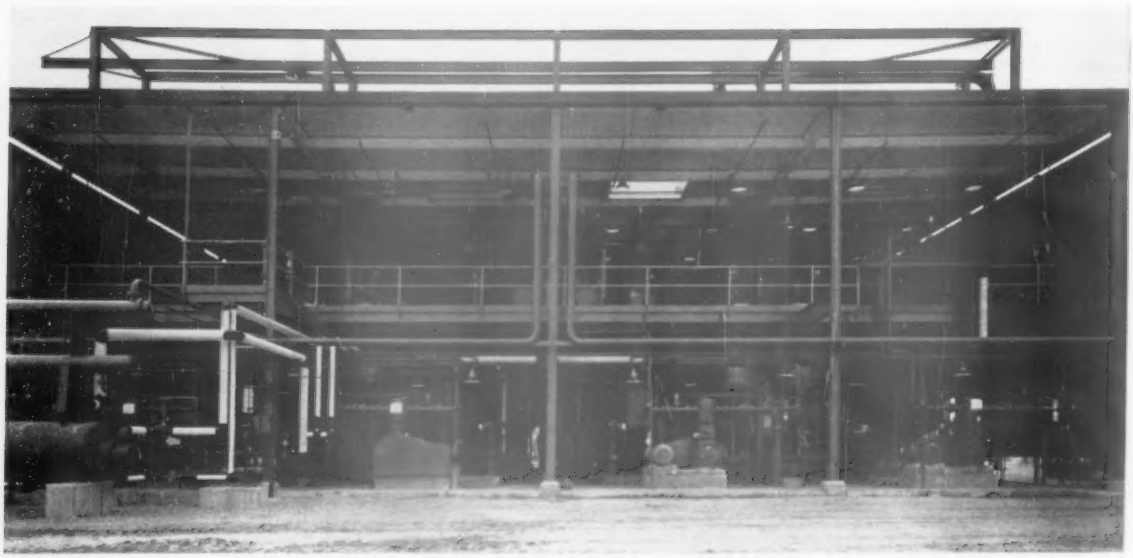


MERGER of Bay Refining and Bay Pipeline with Dow laid the groundwork for this petrochemical complex. Fig. 1.

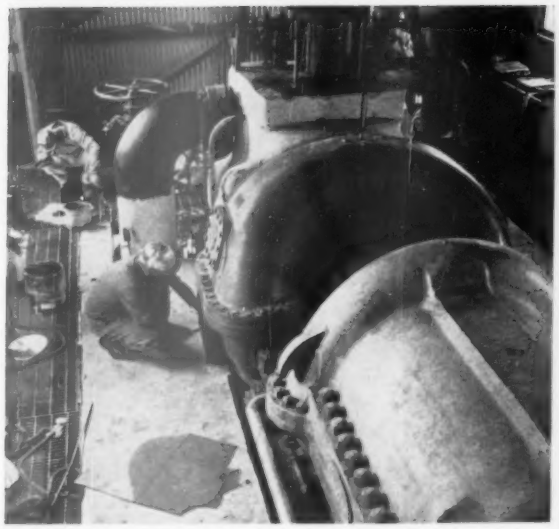
New petrochemical complex serves North Central States

APPROXIMATELY one-third of Dow Chemical Co.'s total sales revenue is derived from plastics materials. And the most recent source of these materials is the new Saginaw Bay Division petrochemical complex located at Bay City, Mich. Completion of these new plants means that the concentrated manufacturing area in the North Central States now has a nearby source of petrochemicals and plastics.

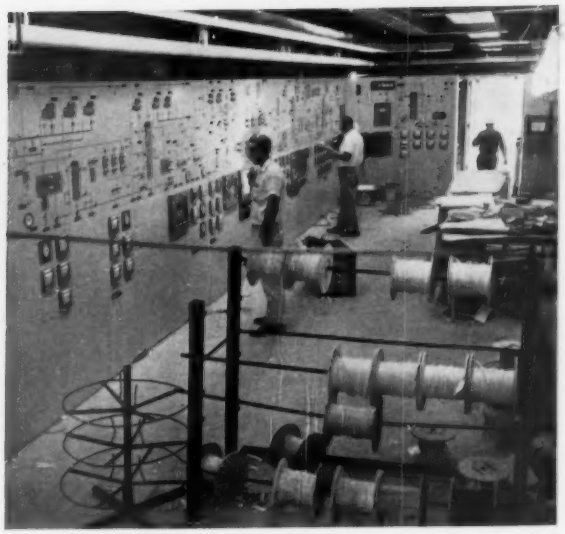
One of the unusual features of the Saginaw Bay operation is its ability to use straightrun refinery products obtained from locally available Michigan crude. This is in contrast with Dow's other petrochemical plants in Texas and Louisiana that are geared



ETHYLENE is converted into linear polyethylene in these reactors using the low-pressure (Ziegler) process.



GIANT COMPRESSORS are needed to send products back to Dow's Midland plant.



CONTROL ROOM in the Petrochemicals Plant is modern and complete with graphic panel and alarm lights.

to LPG as a raw material.

This chemical complex is made up of two plants, the petrochemicals plant and the polychemicals plant.

The petrochemicals plant gets straightrun gasoline and kerosine by pipeline from Dow's Bay Refining Co. nearby. These raw materials are cracked into a number of other hydrocarbon materials including ethylene, propylene, and butadiene. Some high-octane gasoline and other valuable fuels are also produced in the cracking process and these are returned to Bay Refining for blending with its premium gasoline.

Part of the ethylene and all the butadiene are piped to Midland for processing into styrene plastics, solvents, latexes, and agricultural chemicals.

The remaining ethylene is sent to the Polychemicals plant for conversion into linear polyethylene, which in turn is formed into pellets or transparent film for marketing.

These new facilities at Saginaw Bay have resulted in several benefits for Dow:

. . . The capacity for producing polystyrene in the Midland plant has been doubled.

. . . Polyethylene is now being produced in an area of concentrated manufacturing.

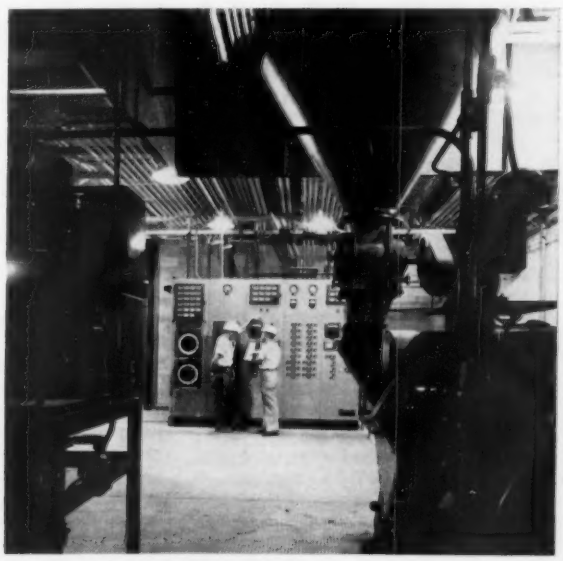
. . . An expansion of ethylene dibromide production has been made possible.

. . . An expansion of power facilities to take care of anticipated production expansion has resulted.

. . . A local supply of butadiene has been provided.

In order to produce ethylene economically from purchased petroleum, there must be an outlet for the byproducts. The merger of Bay Refining and Bay Pipe Line with Dow in 1956 provided this combination of petroleum source and outlet with petrochemical manufacture. The groundwork was thus laid for a new era in petrochemicals in the North Central states.

NEW COMPLEX has its own waste-disposal facilities for processing liquid wastes.



POLYETHYLENE PELLETS and powder are mixed and blended in this section of the polychemicals plant.

THIRTY-INCH GAS-TRANSMISSION LINE under construction in southern Ohio. Insert shows typical strain-gage array at a field-made bend in the pipeline.

Here's what was learned from a study of

Strain gages on big-inch gas pipelines

• Secondary stresses have an effect on the behavior of a line during operation. The 10-company program coordinated by Battelle Memorial Institute for stress analysis described here is a major step in pipeline design.

DURING the past few years the American Gas Association has been carrying out an ambitious program of research to experimentally determine some of the so-called secondary stresses in natural-gas pipelines. The program has involved extensive use of bonded-wire strain gages—in many cases under rather adverse field conditions. A number of problems of gage application, waterproofing, wiring, and instrumentation were overcome.

Presented at ISA winter Instrument-Automation conference, Houston.

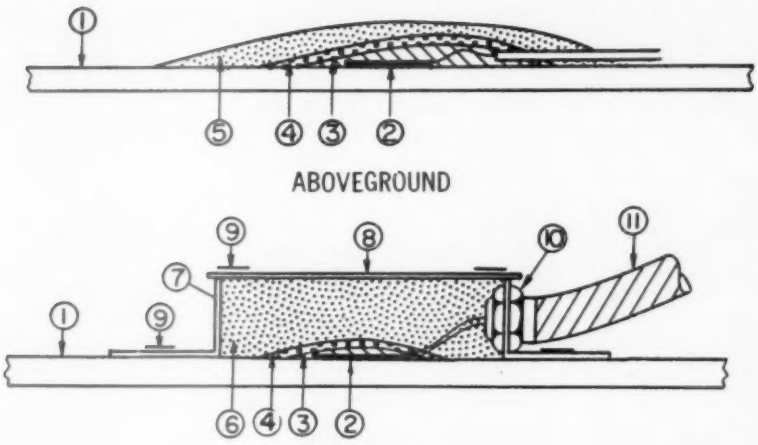
Some of the problems and the techniques that were used to overcome them will be described here in the hope that they may be of use to others in field work.

The term secondary stress is defined as any stress in the pipeline different from the nominal stresses produced by internal pressure. These stresses are caused by such things as temperature changes, external forces from the weight of the soil, and even the effects of internal pressure at bends and at points where the pipe is out-of-round.

BY GEORGE McCLURE
Assistant Chief,
Applied Mechanics Division,
Battelle Memorial Institute

Secondary stresses cannot be accurately calculated because the conditions of restraints are usually not known. They do, however, have an effect upon the behavior of a line during its period of operation. Thus, the research program to learn more of the magnitudes of the secondary stresses was undertaken.

Ten individual gas-pipeline compa-



① Pipe wall
② Strain gage
③ Glyptal
④ Neoprene
⑤ Microcrystalline wax
⑥ Di Jell wax
⑦ Formed sheet-metal angle
⑧ Removable sheet-metal cover
⑨ Metal tension straps
⑩ Waterproof connector
⑪ Flexible metal conduit, neoprene coated

TWO METHODS OF WATERPROOFING that have been relatively successful.

nies have cooperated by carrying out experimental stress-analysis programs at selected points on their own pipelines. Battelle Memorial Institute served as coordinator for the project. Initially, two seminars were held by engineers from the participating companies to discuss field use of strain gages. At these seminars, many of the problems in field use of gages were anticipated and solutions were discussed.

Field installations have been made at about 30 individual locations at various places in the country to date. Some of these are still in operation and readings are being taken after as much as 3 years. Most of these are underground installations—some are aboveground piping. Typical types of installations are at bends, at branch connections, at main-line valves and concrete anchors, at points where the pipeline goes underneath a river, or at suspension bridges across a river.

In most cases the gages were installed at the time the pipeline was newly constructed; however, in a few cases the gages were installed after the line had been in operation for some time. In addition to strain-gage readings being taken at each of these locations, normally a number of other quantities are measured also—for example, pipe, ground, and air temperatures, internal pressure in the line, pipe movements, etc.

All in all, from a stress-analysis standpoint, this project represents a major step forward in pipeline design.

General Considerations

A typical installation at almost any point on a pipeline might consist of a ring of gages around the pipe. This ring might be made up of a pair of gages—that is, one circumferential and one longitudinal gage—placed every 45° around the pipe. With this arrangement both circumferential and longitudinal stresses in the pipeline can be determined.

In some cases if torsional forces on the line are suspected a number of the gages might be rosettes. Also on the typical installation there would probably be two compensating gages applied to small squares of metal and placed in intimate contact with the pipe wall.

This typical installation might have been made during the time that the pipeline was being constructed or it might have been made after some period of operation of the line. In either case there are a number of rather unusual problems that arise in field work of this type.

1. A quite common problem involves scheduling operations so that the progress of the pipeline contractor is not hindered when gages are installed during construction. In most such instances there are only a few hours available to make the complete strain-gage installation. This often prevents the use of many of the types of gages and waterproofing agents that require long heating or curing times. In fact, in the past, this problem has prevented the use of bakelite or epoxy-based cements because of the long time and high temperature required for curing. Most of the installations on pipelines to date in this AGA program have been made with SR-4 type gages with a thin paper base such as the A-3 or A-5-1.

2. Another major problem involves the working conditions under which the instrumentation has to be applied. Often the protection has to be provided against rain or other high-humidity conditions. On the other extreme, conditions have also been met where in direct sunlight the pipe to which gages were being applied became too hot and had to be shaded to prevent the first application of cement from bubbling.

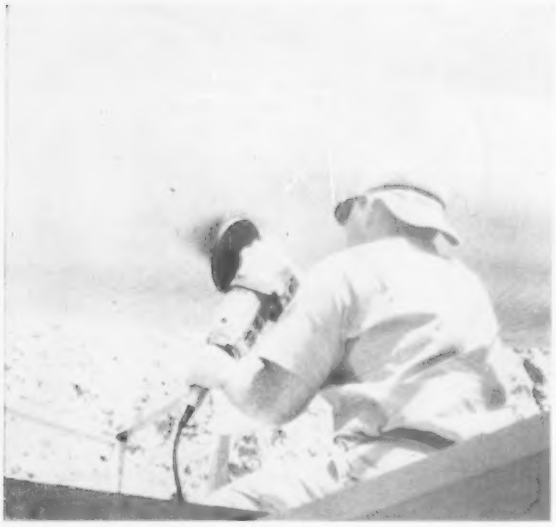
3. The third, and probably the largest problem met in these pipeline strain-gage applications, arises from the main objective of the work. In most cases it is a major objective to obtain strain-gage measurements over a period of 1 year or more so that the stresses from one season to another in the year can be determined. It is not possible to reproduce the zero-reading conditions; therefore, it is quite important that the entire gage circuit have good stability. (Normally in field installations such as these an accuracy of 30 to 50 microinches per inch is considered good.) Probably the greatest source of instability is electrical leakage produced by moisture getting into the gages or lead wires. Thus, waterproofing of the gage and lead wires is a major requirement.

It is not practical to describe in detail all the methods of field application that have been used by the various participating companies—instead two of the most successful methods will be discussed.

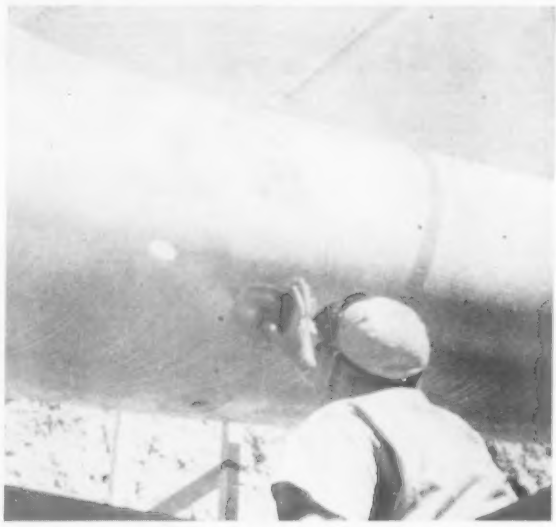
Gage Application

In most of the pipeline work to date paper-base SR-4 gages were used; therefore, the discussions on applying and waterproofing gages will be restricted to this type of gage. The usual procedures were used in applying these gages. The pipe surface was first ground to a bright finish. The final grinding or polishing should be done with approximately a 180-grit emery paper or equivalent. A large enough surface should be prepared so that the successive layers of waterproofing and materials later applied will have a clean metal surface to adhere to.

A portable electric grinder is a



GRINDING the areas for the gages . . .



APPLYING the gages . . .

handy tool for preparing the surface for gage application; however, a precaution should be taken that too much metal is not removed. In the case of a pipe or pressure vessel, if too much of the wall thickness is ground away, the results will, of course, be affected.

The detailed procedures and steps to be used in applying a gage are described in manufacturers catalogs and bulletins and also in a number of excellent references on this subject.[1 2 3 4]

In field work, one of the major problems is the adequate drying of the gages. Except possibly in sunny, dry weather, infrared heat lamps were used to accelerate the drying. A 1½ or 2-kw. gasoline-powered generator is usually sufficient to supply power for an adequate number of lamps.

One difficulty in this respect that is occasionally met in indoor work is that the temperature of the structure is below the dew point, causing continuous sweating or moisture condensation on the structure. In the author's experience this situation was met twice in pipeline applications in which there was some gas flow in the pipe. The pipe wall could not be heated to a temperature above the dew point; therefore, the gage application on that particular day had to be abandoned.

Normally, however, with Types A-3 or AR-2 (rosette) gages (both of these have a thin paper base for rapid solvent elimination) it is possible to apply the gages and dry them sufficiently in about 3 or 4 hours. The best method of determining sufficient drying is by measurement of the leakage resistance to the structure on which the gage is applied.

When first applied and the nitrocellulose cement is still wet, the resistance to ground will be quite low—

WIRING completed and waterproofing started . . .

COMPLETED installation encased in metal box around pipe.

less than 1 megohm. As time proceeds, this resistance increases. It should go over about 500 megohms to ground before any of the coatings for waterproofing the gages are applied. Later, when readings are being taken, the resistance to ground should be on the order of 500 megohms to ground. It is possible, however, to get good readings with a resistance to ground as low as 25 megohms.

In determining the resistance to ground of the gage circuit, care should be taken that an instrument with a high-voltage output is not used. The maximum recommended voltage is 22 volts—a much higher voltage might be sufficient to produce a breakdown through the paper base and cement.

Waterproofing

Much experimentation was carried out in laboratory tests to find a suitable type of moistureproofing.[3 4] The usual procedure in these laboratory tests was to apply Type A-3 gages to

a strip of metal with appropriate lead wires and coat the gage with the various types of coatings under investigation. Then the strip of metal was subjected to bending and immersed in salt water. Strain readings were then taken over a period of time along with leakage-resistance readings between the gage and the strip of metal. Several combinations of materials or coatings were found to be satisfactory under these conditions in the laboratory. However, when some of them were used under field conditions in buried soil, the results were quite unsuccessful.

The exact reason for this inconsistency in results is not known; however, there are two possible explanations: (a) in the underground experiments it is possible that movement of the pipeline subjected the gage or lead wires to excessive stress, or (b) the leakage to ground in the underground experiments may have occurred through the electrical lead-out cable rather than through the waterproofed coatings applied over the gages themselves. Whichever the case, the problem of waterproofing for long periods of time in the ground under soil conditions has been shown to be quite a bit more difficult than submersion in still water.

Two methods of waterproofing that have been relatively successful are shown in the sketch. The top one in the figure is considered suitable for aboveground installations and the bottom one is considered preferable for underground installations.

In the system shown at the top, it will be noted that there are successive layers of Glyptal enamel, liquid neoprene, then microcrystalline wax. This system of waterproofing has been found satisfactory for a number of aboveground installations (and also in the laboratory tests of test specimens submerged in salt water).

In the method shown at the bottom for underground installations, the main difference is the addition of a metal box structure filled with Di-Jell (a soft and pliable microcrystalline wax) over the gage. This box is formed so that it encircles the pipe, completely covering the ring of gages. The flexible rubber-covered metal conduit is an additional protection for the lead wires.

In both of the methods shown, and for that matter in any waterproofing technique, there are certain important rules to follow:

1. Cleanliness. This is extremely important and cannot be overemphasized. The area surrounding the gage to which the successive coating must adhere must be very clean and free from any oil films, fingerprints, etc.

2. Drying each successive coating. In the case of coatings such as Glyptal and liquid neoprene, which are put on in successive layers, each layer must be completely dry before the succeeding layer is applied, otherwise the advantage of the successive layers is lost. The dryness of the first few layers applied on top of the gage may be checked by determining the leakage resistance between the gage and the metal structure to which it is applied, just as was suggested for checking the drying of the gage cement. After each layer of coating material is applied it will be noted that the leakage resistance decreases and that it also increases as the drying of the coating proceeds.

3. Much better success is achieved if each of the coatings can be applied while the heat lamps are still operating and warming the metal areas around the gage. This apparently improves the adherence of the coatings and also their rapid elimination of solvent.

Wiring

In general, either 18 or 20-gage solid-copper conductor wire was used. The lead-wire resistance should not be more than a few per cent of the gage resistance; therefore, if very long leads are necessary in an installation a larger diameter wire should be used.

In all underground installations it has been found profitable to provide a separate lead wire for each gage lead. In other words, no leads should be used that are common to a number of gages. The reason is that if one gage becomes shorted to ground or in some other way becomes inoperative, it can "spoil" any other gages that are wired in the same circuit.

It is not difficult to find cable with the desired number of pairs of wires. For example, there is a telephone-wiring classification "aerial and duct" which has an outer sheath of neoprene and also an aluminum or plastic moisture barrier inside and almost any desired number of wires which are individually insulated and color coded. This type of cable has been found to be quite suitable for aboveground installations.

For underground installations this same type of cable has been used but placed inside a flexible metal conduit. This provides an additional moisture barrier and also protection from mechanical damage from the soil. There is also a telephone-wiring classification of direct-burial cable which is quite suitable for underground strain-gage installations.

In any strain-gage installation it is advisable to leave a small expansion loop in the wire adjacent to each strain gage. This, of course, is to insure that any small amount of movement that does take place will not break the circuit to the gage.

Another precaution to be taken in any aboveground installation or an installation around any equipment that is warm or hot is to insure that all lead wires are at the same temperature. If a temperature difference exists between an active gage lead wire and one of the compensating gage lead wires, it will show up as an apparent strain in the strain-gage readings. This is because the resistance of the lead wire itself changes with temperature and the change as small as a few hundredths of an ohm is sufficient to introduce an error in the strain results.

It has been quite common in the pipeline strain-gage installations to have more than 100 gages in one installation. Such an installation, of course, requires that a good and stable switching arrangement be used. The switch must have a very low contact resistance and must also be protected from adverse weather conditions.

Experience With Specific Installations

The experience in the past few years in the AGA program with field use of strain gages has been varied. In a few installations nearly all of the gages soon became inoperative. In most of these cases the installations were made during very adverse field conditions. For example, three installations were made within a few miles of each other on a 30-in. pipeline being constructed in Texas during 1957. All were on buried pipe at various locations (a road crossing, a main-line anchor, and adjacent to a main-line valve). These installations were made after the pipe had been lowered into the ditch but before the ditch was backfilled.

Unfortunately, these installations had to be made during a rainy period. Even though all precautions were taken through the use of tents and heat lamps to maintain low moisture conditions during the gage application and waterproofing, it was later found that over half of the gages became inoperative after 6 months and all of the gages went out before a year had passed. Thus, the importance of good weather and low humidity in field work was emphasized.

In a number of other installations, however, a much greater success has been achieved and readings are still being taken as much as 2 years after installation of gages. Some specific examples of these follow.

Two companies installed a large number of gages on some 30-in. piping adjacent to overhead river crossings in Nebraska and Missouri. These installations were made to determine the effect of pressure and temperature changes on stresses in the piping and to check the results with the original

design calculations. Both methods of waterproofing shown in the diagram were used. In one case, 363 Type A-3 and Type AR-2 gages were used (paper-backed gages applied with Duco cement).

All of these gages were close enough together that all of the lead wires were taken to a central metal house where a central switching facility was used. The house was heated and the individual switch boxes contained a desiccant to maintain the switches in good condition. After 2½ years of operation, only nine gages have been lost. All of the rest have a leakage resistance to the pipe wall of at least 500 megohms.

In the other aboveground installation, 240 gages were used of the same type. After 1½ years only 23 gages have been lost—mostly because of a short to ground.

In both of these aboveground cases, there is evidence that only a very small amount of gage drift (probably because of aging of the cement) has occurred.

An example of six successful underground installations is shown by a company which installed gages at six different locations in Kentucky during the summer of 1957. Each location consisted of a ring of eight gages applied in pairs every 90° around the pipe. The method of waterproofing shown at the bottom of the diagram was used. Similar to the installations mentioned above in Texas, these in Kentucky were made after the pipe had been lowered into the ditch, but before the backfill had been placed over the pipe. Of a total of 48 gages at the 6 locations, only 2 gage failures have been recorded in slightly over 2 years. One of the gage circuits became open and another gage became directly shorted to the pipe wall. All of the remaining gages have a leakage resistance to ground in excess of 200 megohms and are still apparently giving satisfactory readings.

These examples of field installations serve to illustrate the success that can be obtained under proper conditions. There are also a number of other installations across the country in which successful readings are being obtained.

Materials Used in Waterproofing Strain Gages

Glyptal No. 1201, red enamel, General Electric Co.

Gaco N-700, liquid neoprene, Gates Engineering Co.

Petrosene microcrystalline wax, Socony Mobil Oil Co.

Di-Jell 171, L. Sonneborn Sons, Inc.

References

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2. Perry, C. C., and Lissner, H. R., "The Strain Gage Primer," McGraw-Hill Book Co., Inc., New York, 1955.
3. Shipp, D. L., McClure, G. M., and Grover, H. J., "How to Use Bonded-Wire Strain Gages for Determining Secondary Stresses in Pipe Lines," The Pipeline Engineer, November and December, 1956.
4. Dean, Mills, III, "Techniques for Protecting and Waterproofing Resistance Wire Strain Gages," David W. Taylor Model Basin Report 797, March 1956.

Acknowledgment

The information presented here resulted from the cooperative efforts of a number of natural-gas pipeline companies. The author wishes to thank the following companies for their cooperation in furnishing data for the paper:

Columbia Gas System Service Corp.
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Southern California Gas Co.
Texas Eastern Transmission Corp.
Texas Illinois Natural Gas Pipeline Co.
Transcontinental Gas Pipe Line Corp.
United Gas Pipe Line Co.

Credit Omitted

Credit for Figs. 1 and 2, "How to estimate Heat Exchangers," OGJ, Jan. 18, 1960, was inadvertently omitted. These figures were reprinted from Industrial and Engineering Chemistry, Vol. 34, 1942, page 990; copyright 1942 by the American Chemical Society, by permission of the copyright owner.

Nelson Refinery Cost Indexes

Published in the first issue each month in the Technology-Operating Section.

Compiled by W. L. Nelson, technical editor and petroleum-refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the months of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis)

Explained on page 101 of the issue of August 5, 1957.

	1950	1954	1957	1958	1959	Nov. 1959
Pumps, compressors, etc.	138.2	166.5	206.7	214.7	226.5	226.8
Electrical machinery	134.9	160.0	188.9	192.7	195.8	197.7
Internal-combustion engines	126.0	150.5	173.9	178.3	178.5	177.9
Instruments	127.8	154.6	187.4	194.9	201.0	198.6
Heat exchangers	140.0	171.7	203.6	181.2	178.9	186.2
Misc. equipment average	*126.2	160.7	192.1	192.4	196.1	197.4
Materials component	149.5	174.6	201.9	204.2	207.8	209.2
Labor component	144.0	183.3	208.6	220.4	231.6	236.6
Nelson construction index	146.2	179.8	205.9	213.9	222.1	225.6

*Used in computing the Nelson Index until April 1952.

Refinery Operating Cost Indexes (1956 Basis)

Explained on page 171 of the issue of June 1, 1959.

	1946	1952	1954	1957	1958	Oct. 1959
Fuel cost	49.6	81.0	86.5	*115.1	*102.1	102.6
Labor cost	73.1	88.7	90.9	106.1	105.0	104.5
Wages	52.4	81.5	88.7	104.1	105.4	110.5
Productivity	68.3	90.2	97.1	98.1	100.3	105.7
Investment, maintenance, etc.	51.2	83.6	92.0	105.4	109.5	115.3
Chemicals cost	37.0	72.1	85.7	102.2	104.4	113.0
Operating cost indexes:						
Refinery	58.5	80.5	88.7	*106.7	*105.8	108.7
Process units†	62.9	82.2	88.4	*107.7	105.8	107.4

*Revised. †Add separate index for chemicals, if any are used.

Chemical inhibitors combat paraffin deposition

PARAFFIN PROBLEMS have been reported in most of the oil-producing areas of the United States, as shown here. Fig. 1.

• Field tests using new paraffin inhibitor show that deposition can be eliminated, or effectively retarded in wells treated with the chemical. Downhole equipment must be clean for effective application.

BY C. F. PARKS
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Tulsa

PARAFFIN DEPOSITION on metal surfaces of oil-well pumps, rods, and other downhole equipment, as well as surface valves and flow lines, is an expensive nuisance. Its cost has been tremendous; expense for periodic deposit removal, production losses resulting from restricted flow capacity, and unproductive down time.

Numerous methods have been developed for removing these plugging deposits: Mechanical, thermal, and chemical methods, and combinations of these three.

The mechanical method involves the physical scraping deposit from the tubing. Thermal methods include circulating hot oil or hot water down the well bore, or the use of bottomhole heaters. The chemical method involves the use of special solvents that dissolve the paraffin so that it can be brought to the surface in liquid form.

A new approach to the paraffin problem has been the development of special chemical inhibitors which form a protective film on exposed metal surfaces in the well.

Presented at the Southern District API meeting, San Antonio, March 16-18, 1960, under the original title "A Chemical Method of Inhibiting the Deposition of Paraffin."

The paraffin problem is found in all the major oil-producing areas of the United States. The map shows some of the principal trouble spots, as reported by Shock et al.[1] in 1954. Additional areas, reported since that time, include western Kentucky, the Williston basin, and the Four Corners area.

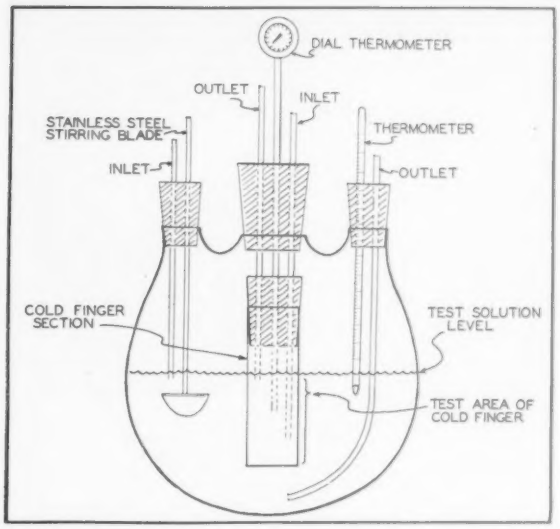
The paraffin problem. It is generally accepted that the major causes of paraffin deposition are the cooling of the crude oil during production, and the escape of light ends or gases which previously helped retain the paraffin in solution in the oil. Other contributing factors as summarized by Reistle[2] are:

1. Alternate coating and draining of oil.
2. Contact of oil with a cold surface.
3. Spraying of oil as a mist.
4. Flow of oil at a low rate.
5. Agitation hastening paraffin particle growth.
6. Sand, silt, water.
7. Rough tubing surfaces.
8. Viscosity of oil not so high as to prevent wax particles from settling out.

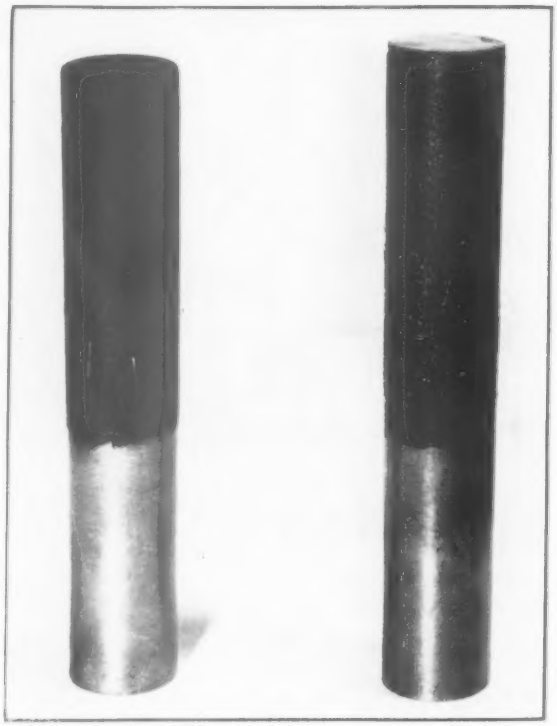
As a result of these influences, paraffin deposits occur at the bottom of the well, in tubing, and in surface equipment. Paraffin deposition in surface flow lines has been alleviated by the installation of large-diameter lines, or the use of pumpable plugs. When such paraffin deposition occurs below the surface, however, its removal is more laborious and costly.

Remedial expense varies widely in different cases, depending on well conditions and severity of the problem. An average of from 2 to 10 cents per barrel of crude is involved. In addition to the obvious costs of paraffin removal, decreased equipment life and increased lifting costs should be recognized. These costs can be minimized by periodic chemical treatment to inhibit downhole paraffin deposition.

Paraffin inhibitors. These are chemical substances which establish and maintain a film over downhole-equipment surfaces, forming a barrier that reduces the adherence of paraffin to the exposed metal. Several have been developed that are cheap, easily applied, and compatible with refinery processes. Small concentrations of



APPARATUS used to put the paraffin coating on the test specimens. Fig. 2.



PARAFFIN-COATED metal cylinders following removal from the oil bath. Fig. 3.

corrosion inhibitor provide protection to metals without actually neutralizing the corrosive agents, and paraffin inhibitors work in a like manner; small concentrations protect exposed metal surfaces from paraffin accumulations.

These chemicals are designed to produce a water-wet coating on the exposed metal surfaces. Although oil and dissolved paraffin may completely cover this water-wet film, they are prevented from becoming firmly attached to the underlying metal. Any accumulation of solid paraffin is so loosely adherent that, rather than restrict the flow of fluids past it, it is detached and carried away before it enlarges.

These inhibitors have no practical solvent effect on paraffins, functioning rather as deterrents to deposition. For effective well protection, therefore, it is essential that they be applied to clean surfaces, so that they may form the necessary water-wet film in direct contact with the metal.

Laboratory tests. The effectiveness of these paraffin inhibitors was demonstrated by a series of relatively simple laboratory tests, Fig. 2. The procedure consisted of immersing a metal cylinder, maintained at 90° F., in crude oil, saturated with paraffin. The temperature of the oil, which has a cloud point of 102° F., was maintained at 120° F. The oil-paraffin solution was agitated and circulated, so as to simulate the flow of oil past well equipment. After a specific time interval, the metal cylinder was removed from the oil. The surfaces which were in contact with the oil were then coated with congealed oil and paraffin.

Two metal cylinders were so prepared, one of which had been previously treated with paraffin inhibitor. Each of these cylinders was immersed simultaneously in tap water at room temperature (80° F.). The test results may be seen in Figs. 3 to 7. Fig. 3 shows the metal cylinders following their removal from the oil bath. The cylinder on the right has been previously treated with paraffin inhibitor, the cylinder on the left untreated. Fig. 4 shows the two test cylinders, 10 seconds after immersion in water. As may be seen, most of the coating has been detached from the treated metal surface of the cylinder on the right. Figs. 5 and 6 show progressive stages of deposit removal and, 10 minutes after immersion, the treated cylinder is almost completely clean, Fig. 7. The untreated cylinder is still coated with oil and paraffin. These comparative tests show the effectiveness of paraffin inhibitors in reducing the adherence of oil and paraffin deposits to metal surfaces.

Field treatments. Effectiveness of these paraffin inhibitors has been confirmed by field tests. For example, in Hutchinson County, Texas, a well producing from the Panhandle dolomite formation had paraffin difficulties. Following the installation of new, small-diameter tubing, the well was treated with a cleaning solution containing inhibitor. After that, daily treatments with paraffin inhibitor were begun. Nine months later, this well was a good producer with no evidence of paraffin blockage.

An offset well, also equipped with new small-diameter tubing, was put into production at about the same time. It, however, was treated daily with 1 gal. of paraffin solvent. In spite of this, it was necessary to pull tubing on this well after 73 days, due to paraffin accumulation.

Effectiveness of these paraffin inhibitors is known to be dependent upon the cleanliness of the well equipment, prior to inhibitor application. To illustrate, three wells in Bisti field of New Mexico, producing a 59°-API-gravity, paraffin-base pipeline oil, were treated by different methods. The first well was cleaned of paraffin, using hot oil, and not further treated. The second well was also cleaned with hot oil, then treated down the annulus with paraffin inhibitor. The third well was first hot oiled, then treated with a solution of degreasing chemicals and the paraffin inhibitor. The latter treatment was designed to remove oil and paint from the metal and to establish the inhibitor film.

Thereafter, the second and third wells were treated daily with additional paraffin inhibitor.

As a result of these treatments, paraffin deposition was effectively retarded in the third well, the other two wells didn't improve.

Two other wells in Sheridan County, Kansas, were experimentally treated with paraffin inhibitor. Both wells were on the same lease, less than 600 yards apart, producing an asphalt-base crude, 30° API, from the Kansas City lime at 3,700 ft. About 2% of the produced fluid was water.

One well was maintained as a control; the other treated with a dilute solution of paraffin inhibitor. Both wells were treated with hot water to remove previous accumulations, the test well was then given additional daily treatments with inhibitor over a 7-month period. No paraffin difficulties were experienced during this time The flow lines from the control well showed a pressure buildup and treatment was required.

At the conclusion of the test period, rods were pulled from both wells. A heavy, uniform paraffin deposit was found on the rods coming from the control well. The rods removed from the inhibitor-treated well were essentially clean, but showed random accumulations of hard paraffin. It was found that the rods were painted beneath these patches of paraffin. This again illustrates the importance of proper cleaning prior to inhibitor treatment, for in this case the paint interfered with the formation of an inhibitor film on the metal.

Treating techniques. The inhibitor treatment procedure believed most effective involves three steps; (1) Removal of existing paraffin deposits by conventional methods, (2) removal of oil, paint and other adherent materials from the metal to be protected, and establishment of an inhibitor film. This is done by using a hot solution, containing a degreasing agent and the paraffin inhibitor, and (3) the periodic addition of paraffin inhibitor to the well. Field tests are currently being conducted to determine the maximum effective amount of inhibitor required and the optimum frequency for applying the inhibitor.

Reference

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2. Reistle, C. E., USBM Bulletin No. 358 (1932).

STEPS in the easy removal of paraffin from the inhibited cylinder is shown in Figs. 4, 5, 6, and 7. The clock shows that the inhibitor works to permit paraffin removal in less than 10 minutes under laboratory conditions.

BY W. L. NELSON, Technical Editor and Petroleum Consultant

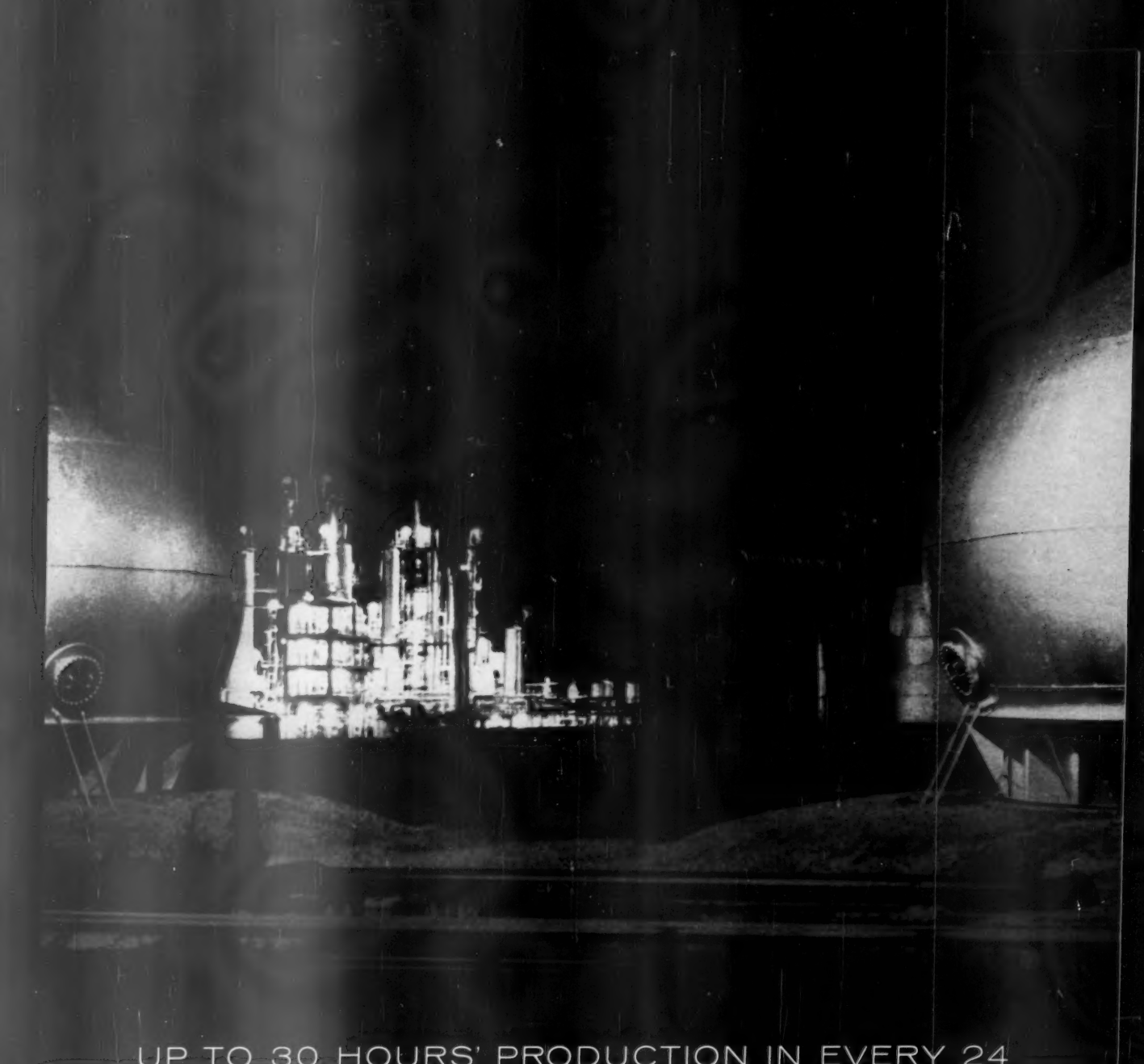
COSTimating

Itemized Cost Indexes

THE COST INDEXES may be used to convert prices at any date to prices at other dates by ratios of the cost indexes of the same date. Itemized indexes are published each quarter (first weekly issues of January, April, July, and October). In addition, the Nelson Construction and Operating Cost Indexes are published in the first issue each month of The Oil and Gas Journal.

Operating costs (based on 1956 as 100.0):	1950	1954	1957	1958	1959	Nov. 1959	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Technology issues
Power, electric, industrial	97.3	¶98.5	¶101.6	102.8	103.2	103.1		
Fuel, refinery	70.3	86.5	¶112.0	¶102.1	103.5	103.7		No. 4—Mar. 17, 1958
Gulf cargoes	78.0	85.9	123.8	102.9	93.5	93.5		No. 4—Mar. 17, 1958
N. Y. barges	76.9	82.6	112.3	93.0	85.9	85.9		No. 4—Mar. 17, 1958
S. Pedro bunkers	65.9	84.3	129.2	114.6	99.5	99.5		No. 4—Mar. 17, 1958
Oklahoma	77.7	62.0	105.3	66.3	78.8	74.0		No. 4—Mar. 17, 1958
Natural gas at wellhead	60.2	¶93.5	¶110.1	¶118.3	130.3	133.4	Code 531-01	
Industrial chemicals	83.3	96.9	101.9	101.8	102.1	102.1	Code 61	No. 58, Oct. 12, 1959
Phosphoric acid	86.7	96.6	100.9	103.4	103.4	103.4	Code 611-07	No. 58, Oct. 12, 1959
Sulfuric acid	80.8	100.0	100.0	100.0	100.0	100.0	Code 611-09	No. 58, Oct. 12, 1959
Ammonia	104.8	103.0	98.3	103.8	105.1	104.1	Code 611-13	No. 58, Oct. 12, 1959
Lime	64.6	92.0	106.4	104.4	106.1	106.8	Code 611-29	No. 58, Oct. 12, 1959
Sodium carbonate	75.5	92.9	104.3	104.3	104.3	104.3	Code 611-65	No. 58, Oct. 12, 1959
Sodium hydroxide	76.3	90.9	103.6	112.6	115.7	115.7	Code 611-69	No. 58, Oct. 12, 1959
Sodium phosphate	87.5	95.5	101.1	104.6	104.6	104.6	Code 611-71	No. 58, Oct. 12, 1959
Furfural	79.0	100.0	100.0	100.0	100.0	100.0	Code 612-63	No. 58, Oct. 12, 1959
MEK, drums	80.0	94.5	105.2	106.9	103.3	103.3	Ch. & E. News	No. 58, Oct. 12, 1959
Phenol	81.3	90.4	103.2	102.7	96.8	95.2	Code 612-83	No. 58, Oct. 12, 1959
TEL	94.1	102.8	101.5	99.9	100.7	100.6	Supplier	No. 58, Oct. 12, 1959
Operating labor (wages)	72.0	88.7	103.9	105.4	‖111.7	114.1	Employ. & Earn.	No. 55—Nov. 3, 1949
Productivity	85.5	97.1	98.0	100.3	‖108.7	110.0	Employ. & Earn.	Sept. 24, 1956§
Construction wages (1946 = 100):								
Skilled construction	140.0	174.6	196.3	205.1	214.6	219.0	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	148.1	192.1	221.0	235.7	248.6	254.3	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	144.0	183.3	208.6	220.4	231.6	236.6		No. 61—Dec. 15, 1949
Equipment or materials (1946 = 100):								
Arc-welding machinery		158.4	186.6	193.2	192.1	191.3	Code ‡1176	May 2, 1955§
Boilers, tanks, and sheet metal	†136.0	147.3	176.3	175.1	177.2	180.6	Code 1072	Apr. 21, 1952§
Building materials (nonmetallic)	127.0	143.6	159.9	161.7	163.5	163.6	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	132.5	144.7	161.3	162.4	166.4	167.0	Code 1341	No. 20—Mar. 3, 1949
Brick—fireclay	153.4	193.1	232.7	238.7	244.4	244.5	Code 1342	May 30, 1955§
Castings (foundry products)	152.9	181.1	220.5	227.2	231.6	233.1	Code 1015	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	134.6	159.1	184.0	187.0	191.4	191.9	Code 134	No. 20—Mar. 3, 1949
Concrete—ingredients	125.3	142.1	159.7	163.2	164.7	164.8	Code 132	No. 22—Mar. 17, 1949
Concrete—products	124.4	138.5	149.0	151.0	152.9	153.6	Code 133	
Electrical machinery	134.9	159.9	¶188.6	192.7	195.8	197.7	Code ‡117	May 2, 1955§
Motors and generators	135.0	157.7	181.2	186.4	186.4	185.1	Code ‡1173	No. 31—May 19, 1949
Switchgear		171.2	¶212.0	218.8	223.5	226.3	Code ‡1175	May 2, 1955§
Transformers	131.6	161.9	188.0	187.3	188.6	189.2	Code ‡1174	No. 31—May 19, 1949
Engines (composite)	126.0	150.5	173.9	178.3	178.5	177.9	Code ‡1154	No. 36—June 23, 1949
Exchangers	140.0	¶171.7	203.6	181.2	179.3	186.2	Manufacturer	No. 2—Oct. 28, 1948
Copper base		¶190.7	191.4	168.8	169.6	175.0	Manufacturer	
Steel		¶156.8	213.2	190.0	186.4	195.0	Manufacturer	
Fans and blowers	162.9	192.6	236.1	241.7	244.4	244.1	Code 1147	Feb. 17, 1949§
Hand tools	143.2	173.8	214.3	224.7	230.4	231.4	Code 1042	June 27, 1955§
Instruments (composite)	127.8	154.6	187.4	194.9	201.0	198.6	Manufacturer	No. 34—June 9, 1949
Flowmeter (mechanical)	114.0	161.6	203.3	209.9	219.1	219.1	Manufacturer	No. 34—June 9, 1949
Flowmeter (air control)	138.5	179.6	208.2	216.3	223.5	223.5	Manufacturer	No. 34—June 9, 1949
Flowmeter (remote)	135.5	146.5	171.2	176.4	178.1	174.8	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	134.0	167.2	230.9	240.4	258.9	240.8	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	134.1	150.5	204.6	212.6	231.6	231.6	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	135.6	166.3	189.3	200.0	200.0	200.0	Manufacturer	No. 34—June 9, 1949
Pressure gage	101.2	108.6	119.2	119.2	119.2	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	124.0	152.8	171.8	179.7	179.7	179.7	Manufacturer	No. 34—June 9, 1949
Control valve	133.3	162.0	187.8	199.3	199.3	199.3	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	193.0	197.8	201.8	198.9	214.1	212.1	Code 81	No. 7—Dec. 2, 1948
Southern pine	176.9	181.2	187.6	184.7	190.9	194.1	Code 812	No. 7—Dec. 2, 1948
Other soft woods	230.2	252.7	257.6	251.2	266.8	266.9	Code 813	No. 7—Dec. 2, 1948
Machinery:								
General purposes	136.7	159.9	196.5	199.6	206.0	208.9	Code 114	Feb. 17, 1949§
Construction	140.1	165.9	199.4	209.6	217.0	218.2	Code 112	
Oil field	†135.8	†161.9	193.2	192.5	192.6	193.1	Code 1151	Oct. 10, 1955§
Paints—prepared	140.0	159.0	178.1	180.9	179.9	180.9	Code 621	May 16, 1955§
Pipe:								
Sewer	120.7	140.1	168.0	170.1	176.2	177.2	Code 1345	No. 22—Mar. 17, 1949
Black iron	160.0	195.0	256.1	264.8	263.8	263.8	Code 1014-56	No. 19—Oct. 15, 1956
Six-inch line	†159.0	200.5	268.3	276.9	275.9	275.9	Code 1014-58	May 4, 1957§
Pumps, air compressors, etc.	138.2	166.5	206.7	214.7	226.5	226.8	Code ‡1141	No. 29—May 5, 1949
Steel (iron and steel)	152.9	179.6	224.5	228.2	232.4	234.5	Code 101	No. 61—Dec. 15, 1949
Steel—finished steel	153.7	187.1	232.5	240.6	244.7	244.7	Code 1014	July 25, 1955§
Plate		187.0	241.8	252.7	257.4	257.4	Code 1014-26	Mar. 4, 1957§
Structural shapes	162.7	193.4	252.2	262.8	268.5	268.5	Code ‡1014-31	No. 18—Feb. 17, 1949
Seamless tubes, 2-2¾ in.	149.5	199.4	265.4	277.5	285.1	285.1	Code 1014-61	Sept. 5, 1955§
Valves and fittings	†135.8	197.1	243.4	242.7	257.6	267.6	Code ‡1149 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction (1946)	146.2	179.8	205.9	213.9	222.1	225.6		No. 36, Aug. 5, 1957
Nelson Ref. Operation (1956)	72.4	88.7	¶106.7	¶105.8	‖106.9	109.2		No. 2—Mar. 3, 1958
Nelson Ref. Process Oper. (1956)	75.1	88.4	¶107.7	105.8	‖106.3	107.3		No. 2—Mar. 3, 1958

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices."
†Estimated base value for 1946.
‡Net exactly the same items as those published before July 7, 1952.
§Questions on Technology, The Oil and Gas Journal. ¶Revised. ‖Preliminary.



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WPRA refining quiz on

PART 2 OF FOUR PARTS

CATALYTIC CRACKING

Here are portions of a discussion at a regional meeting of Western Petroleum Refiners Association in El Dorado, Ark.

The Panel

W. L. BANKS, Moderator
WPRA Technical Director
Tulsa

P. G. WRIGHT
Mobil Oil Co.
East St. Louis, Ill.

R. W. KERSEY
Derby Refining Co.
Wichita, Kans.

R. A. RATLIFF
Continental Oil Co.
Westlake, La.

R. G. ALEXANDER
International Refineries, Inc.
Wrenshall, Minn.

W. F. JOHNSTON
American Oil Co.
Texas City, Tex.

G. M. ROSE
Tidewater Oil Co.
Delaware City, Del.

O. J. ZANDONA
Ashland Oil & Refining Co.
Ashland, Ky.

G. F. ADAMS
DX Sunray Oil Co.
Tulsa

J. E. HARRELL, JR.
Universal Oil Products Co.
Houston

W. L. VERMILION
Standard Oil Co.
Cleveland

P. S. VERITY
Foster Wheeler Corp.
New York

BANKS: What is a good ratio of hydrogen to carbon for catalytic coke and strippable coke? If stripping cat cracking were 100%, what hydrogen-to-carbon ratio would you have?

ROSE: In our Orthoflow B, we normally run under 10% hydrogen on the coke, generally in the 7 to 9% range. Under ideal conditions, our best guess would be that you could achieve 6 to 7% as a minimum.

ALEXANDER: We normally are able to get down around 9% now that we have a new stripper. A couple of years ago, we had just a four-tray disk-and-doughnut stripper, and the best we could do was about 12-13%. We subsequently added a couple of trays. This question of 100% stripping in the stripper was brought up a couple of years ago, and at that time, Dick Haig, of Esso, hazarded a guess that it might be 4% of hydrogen on coke.

BANKS: After lengthening an external catalyst stripper, what has been the experience of optimum bed level and optimum steam as compared to the shorter stripper?

VERITY: Isn't the answer to this particular question really related to the whole question of stripper efficiency? We have found, I think fairly conclusively, that one of the most important factors is getting the catalyst into the stripper very uniformly, and then getting it out very uniformly. We have been as low—on one of our units—as 7% hydrogen on coke, in a stripper in which every attempt was made to get an exceedingly symmetrical and uniform flow of catalyst both into and out of the stripper.

There were no side entries or exits, and we have found that this is probably one of the most important points. I just put this forward as a thought for people who are considering improving catalyst strippers—that getting the catalyst in symmetrically and pulling it out again symmetrically seems to be one of the keys to good stripper design.

ZANDONA: Stripper operation has been a problem for quite some time. We have had rather poor stripping efficiency in most of our units. We have two of the small, UOP stack-type units, and one UOP side-by-side. Recently, we made a change in design, in accordance with UOP's recommendation whereby a steam sparger, which was installed below the bottom catalyst stripping tray, was changed to a steam chest located in the bottom of the stripper. An increase in efficiency of our stripper was noted. In fact, we were obtaining results of hydrogen on coke of about 12%, and after the change we have been able to obtain results of hydrogen on coke of about 9 to 11%.

ADAMS: On the subject of stripping efficiency, and hydrogen on coke, apparently there is a very strong correlation between per cent hydrogen and cat-to-oil ratio. We run quite low on the hydrogen-on-coke in both of our units, around 7 to 8%. We don't feel that it is so much the result of excellent stripper design, as it is that we run with low cat-oil ratios both because of high regenerator temperatures and high preheat. Our cat-oil ratio is about 5 or 6 to 1. I think the best way you can lower hydrogen in the coke is to put in a feed preheater.

MARDAGA: There have been some units built with no baffles in the stripper on the theory that stripping, or displacement of the hydrocarbon in the voids with steam, is nowhere near as important as the residence-time effect, and the thermal aftercracking and disengagement that takes place as a result of holdup in the stripper. I wonder what the reactions of some of the experts here are on the merits of stripper holdup versus the theory of conventional stripping as with a fluid? Would someone care to comment on that?

McKINNEY, Claude (Standard Oil Co., Ind.): Residence time of the catalyst in the strippers is important. And the temperature also is important, particularly if it falls below, say, 890° or 880° F.

MARDAGA: I always felt that the displacement of the void spaces in the catalyst was much more important. After all, catalyst is one-fourth silica-aluminum and three-fourths holes,

and it carries vapors out of the reactor with it as it leaves the reactor.

MASOLOGITES: In the pilot plant we've run cat-oil ratios from 3 on up to 20, and we've had occasion to run these over a space-velocity range of about 3 to 1, which would throw out residence time. We have never been able to come up with anything other than a constant factor for weight percent of coke-basis fresh feed for each unit of cat oil. This seems to be constant. Our pilot-plant data would say there is no significant effect of residence time.

We actually measured hydrogen content of coke in an experimental program. This was a pilot-plant study and we got down to around 5 or 5+ wt. %. We were running a light feed stock and something around 957° F. temperature. I don't believe we would go along on the minimum of 4 wt. % which has been quoted. We tried hard to get down to that by kicking the pilot plant around as hard as we could. There are references in The Oil and Gas Journal corroborating the effect of the cat circulation. (Moorman, J. W., "Space Velocity and Catalyst-to-Oil Ratio Together Provide a Measure of Cracking Severity," (OGJ, p. 106, March 8, 1954.)

BANKS: Is there any difference in the strippability of the three types of catalyst that are now currently used?

ADAMS: With semisynthetic in one of our units, there has been no change in the production of hydrogen as yet.

HATTMAN, J. B. (Davison Chemical Co.): I think that stripping is more a function of pore volume than catalyst. If you have high pore volume, you have good catalyst strippability. It is just a matter of easier diffusion of steam or air in and hydrocarbons or carbon oxides out of the catalyst particles. Diffusion is a function of porosity.

McFATTER, W. E. (Cities Service Refining Corp.): We've found no difference between the types of catalyst on identical strippers; that is, using a natural catalyst or synthetic catalyst. The main difference that we have found has been related to the pore volume. Better stripping is obtained with the high pore volume catalyst.

KERSEY: We have a different problem, perhaps, on a TCC unit in stripping, but we have noticed as our feed gets heavier, that with the same reactor-outlet temperature and with the same stripping-steam rates, we get a much heavier plume as the boiling range of the feed goes up. I wonder if this isn't an important function of the strippability of the catalyst also.

MASOLOGITES: In pilot-plant work we've noticed no difference in looking at the effect of cat-oil on coke, whether it is Filtro natural catalyst or synthetic catalyst. Some work on stripping was carried out on commercial equipment; this involved taking a side-stream sample into a bomb and studying the composition of the hydrocarbons in that bomb. It was found that the hydrogen content of the strippable material was about 11 to 12 wt. %, not too different from the hydrogen content in the feed stock.

This commercial test program was carried out covering a range of cat-to-oil ratios and then extrapolating down to zero cat-to-oil ratio. The number that we came out with was 5.5 weight per cent hydrogen for catalytic coke. This seems to tie in reasonably well with what we've seen on the pilot plant.

Regeneration

BANKS: What is the effect of air temperature on catalyst circulation on a TCC unit?

WRIGHT: We feel it has no effect on catalyst circulation, as such. The main effect of lift air temperature is to maintain the catalyst temperature in the lift system. The thing that effects catalyst circulation in a TCC unit is the secondary air. If you have the capacity in the system, you might increase the velocity of the catalyst in the lift pipe by changing lift air temperature.

BANKS: What is the economic feasibility of injecting oxygen into FCCU regeneration air?

RULIS, Algrid (Cities Service Oil Co.): The article, "Effect of Adding Oxygen to Cat Regenerator Air," The Oil and Gas Journal, October 19, 1959, summed up the results of the oxygen - enrichment test at East Chicago. We found that the method is operationally feasible. For an economic evaluation, each particular case must be studied on its own merits with respect to investment required and physical limitations involved. For example, we recently increased the capacity of one of our air blowers by 50% rather than putting in oxygen-enrichment facilities. Where regenerator size would prohibit additional air, injection of oxygen would be a solution. We feel oxygen injection has a potential application in the event of a shutdown of blower capacity where the unit would continue operating during the blower repair period.

BANKS: To what level do you raise the oxygen content?

RULIS: The biggest quantity of oxygen added during the test amounted to 4.4% on total air which resulted in an oxygen content of about 25% in total regeneration air.

BANKS: And when you got up to the 25% level did you notice any problem in your regeneration heat?

RULIS: No, we were quite satisfied with all operating phases. There were no particular problems.

VERITY: Was there a low oxygen content in the flue gas?

RULIS: The average O_2 content in the flue gas was 0.4%.

BANKS: What is the economic feasibility of using gas - turbine driven blowers utilizing FCCU flue gas? What are erosion problems?

HARRELL: The catalyst fines would be expected to be the problem in this type of installation. We understand this is being worked on.

ALEXANDER: Esso had a pilot-plant operation using the regenerator flue gas to drive the blower, and it was approximately the right size to use on our cat cracker. They offered to sell us the blower and give us the engineering on how to put it in. We declined, but I'm sure that if someone is interested, Dick Haig of Esso Research could give them more information on it.

VERITY: Foster-Wheeler has made quite a detailed study of this problem, and I think we can say that most of the difficulties have been overcome. Obviously, the lower the pressure in the regenerator the less attractive is the system. The lines are bigger, the pressure head is lower, and so on. We find that about 25 psig. in the regenerator is approximately the self-sufficiency point. At much lower pressures, you're going to find the economics are unattractive.

BANKS: What factors other than hydrogen on the coke and reactor temperatures affect the air use in a fluid catalytic cracking unit?

VERITY: I take this question to refer to the efficiency of regenerator operation. We have found from experience on a large unit built within the last year or so, that it seems very important to have countercurrent flow

of catalyst and air. If you put the catalyst in, symmetrically, or centrally, near the top of the regenerator bed, and draw it off near the bottom, the net catalyst flow is countercurrent to the air and you tend to get a high-efficiency regenerator.

We feel that the control of flow within large fluid beds, the control of the flow of the catalyst, is more important than once used to be thought. There seems to be very little natural circulation of catalyst from one side of a bed to the other, although the circulation from top to bottom is very good and very rapid.

Has anybody experienced an improved regenerator operation, that is to say, a lower coke on the regenerated catalyst and a lower oxygen in the flue gas, when the velocity through the regenerator has been increased; in other words, when the load on the regenerator has been pushed to the limit? Some of the experience we've had indicates that the higher velocities result in increased efficiency, which more than offsets the reduced time of contact, etc.

ADAMS: We've noted some other factors affecting air use. Apparently the question was asked from the standpoint of getting maximum use of a cat cracker with limited air for the regenerator. Other direct factors would be the CO_2-CO ratio and the amount of excess air in the flue gas. Indirect factors would be cat-to-oil ratio, which could be controlled by charge-stock preheat, recycle ratio and reactor temperature, all of which could be possibly adjusted to minimize coke production for a given conversion level.

McFATTER: One factor which improves the air use on our unit is increasing pore volume. We've gone to a higher-pore-volume catalyst, and found that by going from 0.31 to 0.45 on the equilibrium catalyst, we've reduced the air requirements from 10.9 lbs. to 10.4 lbs.

ALEXANDER: One thing that we've noticed is that if catalyst gets old and catalyst consumption is reduced, there is a higher CO_2-CO ratio, which tends to increase air requirement for the same carbon-burning level. Increased regeneration air velocity means higher carbon level, even though you do have higher regenerator velocity, and higher grid pressure drops.

ADAMS: Mr. McFatter, in improving your air use, what change took place in using this high-pore-volume catalyst that resulted in this better air use. Was it CO_2-CO ratio, hydrogen in coke, or what?

McFATTER: We got better fluidization, lower oxygen in the flue gas and better CO_2-CO ratio. Oxygen in flue gas went from 0.6% to 0.4%; CO_2-CO ratio went from 0.90 to 0.73; and hydrogen in coke went from 8.3% to 8.0%.

ZANDONA: You mention pore volume as a function of the fluidization of the catalyst in the regenerator itself. I was wondering if you had noticed any change in the particle-size distribution?

McFATTER: We were able to go to a larger particle. 0-20 μ fraction went from 25.3% to 7.7%; 20-40 μ went from 50.0% to 38.0%; 40-80 μ went from 24.5% to 51.1%; and 80 plus μ went from 0.2% to 3.2%.

MARDAGA: One item that affects CO_2-CO ratio is heavy-metals content of catalyst. Nickel and vanadium, for example, catalyze combustion of CO to CO_2. Air distribution in the regenerator is also important. If you have a hole in the grid or preferential leakage around a stand pipe, or for any other reason have poor air distribution, higher air usage will be required. It has been stated that bed depth tends to give a higher CO_2-CO ratio, which would increase air requirements. Also CO_2-CO ratio increases with higher concentrations of water vapor in the regenerator.

Recycling and general operation

BANKS: What is the effect of recycling light-cycle gas oil on pour point and end point if one starts with no light-cycle recycle and then adds light cycle to the recycle without increasing conversion?

ROSE: Recently we added about 20% of desulfurized light-cycle oil; however, rather than put it into our recycle stream it went in with the fresh feed. We noted a decrease in 90% point of about 50° (from about 600° to 550°) and our regenerator temperature dropped from about 1,140° F. to about 1,110°-1,115° F.

DANIEL: We've done this quite often over a period of time. Recycling definitely does increase the end point of the cat light gas oil. To indicate magnitude, 10 to 15% of recycle will give you an increase of 20° to 30° F. Regenerator temperature seems to be related to the conversion level. In the 60-65% conversion range, you seem to get a net cooling effect and your regenerator temperature goes down. By contrast, over 70% conversion, and particularly over 75% conversion, you get a very definite increase in regenerator temperature when you start recycling the cat light.

KERSEY: Until recently, our TCC reactor has been limited by vapor-handling capacity. But moving into the heating-oil season this year we've cut total reactor-feed and fresh-feed rates so that we now have room to vary our recycle ratio. Most recent experience tends to indicate that by increasing the recycle ratio and backing off on conversion, we have actually improved our pour point and end point. We can't say how much yet, because this is just a recent observation. We are trying to gather more data.

VERITY: Some similar pilot-plant work we did for a foreign refiner showed a considerable reduction in pour point of the light-cycle oil. We had to offset it by backing out some heavy recycle, which had a very high pour point, but the refiner was able to use that material somewhere else.

BANKS: Has any reduction in carbon production been noted by the addition of slurry from the settler directly to the top of the dense phase in the reactor?

ADAMS: We practice this at both of our refineries by injecting the slurry from the settler into the dilute phase or the top of the reactor, with the intent of carrying as much of this material back over to the fractionator after removing the catalyst, and without trying to crack it and have the resulting higher coke laydown. It is hard to determine exactly the extent of coke reduction because on a cat unit you always rebalance the unit after you make the change that reduces or adds to the coke laydown.

There is a distinct operating difference when this change is made. They notice a reduction in air requirement and reduction of regenerator temperature, and are able to increase conversion or feed rate as a result of putting the slurry into the top of the reactor. Naturally, we hold the flow of the stream to the minimum we can successfully control.

BANKS: Does anyone use steam in the reactor riser of the fluid catalytic cracking unit for purposes other than carrier medium?

MARDAGA, L. W. (Gulf Oil

This is Part 2 of the 1959 WPRA El Dorado, Ark., question-and-answer refinery meeting report. Part 1 dealt with catalytic reforming and appeared in the Mar. 21 issue. Part 3, dealing with alkylation, control, instrumentation, and Polymerization, will appear in the issue of Apr. 11. Part 4 (treating, coking, and distillation) will appear Apr. 18.

Corp.): At one of our units dispersion steam was increased several fold and, at the same conversion, regenerator temperatures dropped. We reasoned that through improved dispersion we got better reactor distribution and this also resulted in better stripping. Good dispersion can probably come from several things. Pressure drop across the feed nozzle and the feed preheat, or the approach to its boiling point, have something to do with it. As a substitute for good mechanical dispersion of the oil, we found that steam is quite beneficial.

BANKS: What was the magnitude of the steam increase?

MARDAGA: From 1 to 4% by weight on total feed.

BANKS: Would this be operating with natural-clay catalyst, or synthetic catalyst?

MARDAGA: This was with the SR-100 catalyst. I would suspect you would get the same effect with other catalysts.

BANKS: At what kiln temperatures are people operating moving-bed cat crackers?

KERSEY: On our TCC kiln, the temperature above the coils averages about 1,200-1,300° F. with the maximum temperature being about 1,350° F. Presently, we are quite a bit below this maximum, but these have been the highest sustained temperatures we've encountered. We've encountered no operating or maintenance problems.

CHAMBERLAIN, J. P.: We've had some experience with this particular thing; in fact we ran a little experiment on it. We have a 12-ft. packaged kiln, and were curious as to whether the temperatures indicated by the thermocouples underneath the channels were actually the temperatures at which the channels operated. We thought that if we could operate without burning up our channels, we could go to a higher catalyst temperature. We installed a thermocouple which we could use to traverse the kiln 2 in. above the center channel. In addition we installed thermocouples every foot across that center channel.

We found that the temperature of the channels themselves, as compared with those of the existing thermocouples under the channels was within about 50°. We thought the cooling air which we put under the channels would cool them down more than that. The maximum temperature at which we operated was about 1,450° F. At 1,450° F. we ran into a difficulty which we are trying to correct. We were unable to circulate enough catalyst for the amount of oil we were putting into our reactor, so our temperature on our reactor dropped.

It was thought if we could raise the temperature of our catalyst, we would bring the temperature of the reactor up when operating at a temperature of around 1,450° F. When we did, we found that we ran into catalyst deactivation, apparently due to the steam deactivation. At high temperatures, in the range of about 1,450° F. kiln temperature and 1,175° F. reactor seal leg, deactivating is actually due to steam in the seal leg. To correct this, we put in a method whereby we could inject straightrun gasoline in place of the steam—in other words, we have about 60% of the steam going up and about 40% going down the seal leg. The hydrocarbon seal system causes a decrease in seal steam. We have found that when we're up at 1,200° F. seal-leg temperature, we damage the catalyst. About 1,090° F. is where we actually operate.

BANKS: What are the chief factors to consider in the replacement of piston compressors with centrifugal types in cat cracking gas plants?

McCARTHY, Gene, (Clark Brothers Co.): I think one of the first points which is missed sometimes is that reciprocating compressors could be replaced by selling them. There is a constant and strong demand around the country for used units. That is a means of getting rid of present equipment.

Another is that some refiners also have gasoline-plant operations as part of the over-all company operation and field boosters which could use present gas reciprocating compressors. As to installing a centrifugal, the first thing to consider is what kind of drive is going to be used. If a steam turbine is going to be used, the obvious question is, is there a boiler capacity for it? If not, is an existing gas turbine available? That, in some cases, could solve the problem.

ZANDONA: In the replacement of reciprocating compressors with a single centrifugal, our justification was based upon lower maintenance and better onstream factor. We were able to replace 10 reciprocating gas-driven compressors which had high maintenance cost. We had reached a point where we needed to run all of the units all of the time to meet the requirements of our production of the cat cracker. When any one unit went down for maintenance, the cat cracker either had to be reduced in capacity, or the gases flared. Two main items of justification were reduced maintenance, and greater capacity requirement of our catalytic cracking unit.

FORBES, H. W., (Ohio Oil Co.): Is anyone operating a reciprocating and a centrifugal in parallel?

ZANDONA: We have had the occasion to run a 880-hp. reciprocating gas-driven compressor in parallel with a centrifugal compressor and found no ill effects.

CHAMBERLAIN, J. P.: We looked two ways when we bought a new compressor. The break point on a 6-mil electric power for a reciprocating versus a two-stage centrifugal was about 800 hp.

EPPARD, J. H. (DX Sunray Oil Co.): Do you have any figures there on what your maintenance costs were on your reciprocating compressors?

ZANDONA: The yearly maintenance costs of our reciprocating compressors were $12,900 material and $8,630 labor. Labor costs reflect considerable overtime payment.

ADAMS: How are excess air afterburning controllers working?

DANIEL: In our case, we started using a trim combustion air controller about 3 months ago and it is doing a fine job of lining out regenerator operation. It's on a large 100 M.c.f.m. blower, where a one-line change is 1 M.c.f.m. This made it hard to get close control by normal means. The vented air stream (2,500 c.f.m. max.) is controlled from the flue-gas temperature. The controller is normally set for a flue-gas temperature, about 10°-20° F. above the dense-phase temperature.

Catalyst selection, size distribution

BANKS: What is the commercial experience to date on semisynthetic fluid cat cracking catalysts?

OLESZKO, T. J. (Aurora Gasoline Co.): We have used a semisynthetic catalyst of one manufacturer for about 18 months. Our experience has been very satisfactory. We have not noticed any depreciation in quality of the products, and gasoline octane seems to be the same. The product distribution is about the same, too. We have a problem in trying to establish exactly what is going on, since we have a mixed gas-concentration unit, to which everything in the refinery is funneled.

It is a little difficult to put your finger on all of the products, as far as distribution is concerned. The catalyst consumption for a given activity has been about the same. We are running about 0.25 lb. per bbl. for an activity of 33 UOP numbers. We were on low alumina, and switched to the semisynthetic in June of 1958.

ADAMS: We've been using semisynthetic catalyst in one of our cat crackers for about 3 months, switching from low alumina. We have replaced about 40% of the inventory of the unit. We've noticed a decline in activity of the equilibrium catalyst of about 2 UOP numbers. Apart from this we don't have any indications there has been any effect on product distribution except as result of adjustments to compensate for a little lower activity.

We have noticed that the stack loss from the unit has decreased by approximately one-third, and the average bulk density to the catalyst has been declining and has dropped from 0.83 to 0.79. This reduction in stack loss caused the operators to reduce the catalyst addition rate which formerly had been to replace the stack loss. This may account, in part, for the reduction in the activity of the equilibrium catalyst. Because of this reduction in activity we resumed our previous addition rate and started a program to withdraw catalyst. There has been no change in the octane number in cat gasoline.

BANKS: What generally determines the economic feasibility of using low-alumina, high-alumina, natural, or the so-called 'synthetic-natural' catalysts in any given FCCU?

DANIEL, Bill (Standard Oil Co., Ohio): This is a general question. You get into just about all the basic factors related to catalyst usage. If you look at it from a metals-poisoning standpoint, and have to wash metals out of the unit, it's quite likely the lower-price natural or semisynthetic catalyst might be very attractive. If you're interested primarily in activity maintenance, that might dictate use of synthetic catalyst, especially high alumina.

From the product-yield standpoint, reported yield comparisons differ to such an extent that a general comment is hard to make. The relative attractiveness of the various catalysts depends on which of these individual aspects is most important in your particular situation. For this reason, a firm answer cannot be made without a detailed study.

ALEXANDER: Natural catalyst has a distinctly higher CO_2 to CO ratio and if you are worried about air availability, that might be a reason to steer clear of that one.

STEFFENS, Jack (Sohio Petroleum Co.): With high alumina be sure to have adequate dip legs. If too small, the loss is going to be terrific. We tried high alumina with very tight cyclone dip legs 2 years ago and pyramided losses up to about 40 tons a day losses. With a unit that is designed with good dip leg area, high alumina is very attractive, especially in stability of heat.

Do you get a higher CO_2 ratio with a semisynthetic? I agree, certainly, with Mr. Alexander that you get it with the natural. This could be a limitation to our operation if a higher CO_2 ratio resulted.

ADAMS: We've noticed no difference on our CO_2-CO ratio. I suspect the high-alumina problem you mentioned is because of the lower operating density of the catalyst. Apparently it is true that with semisynthetic you might have the same problem as you would have with high alumina, if you have tight cyclone dip legs or are short of disengaging height.

BANKS: Are there quantitative data on the benefits of using a steam attritor for reduction of particle size of circulating catalyst? Is the attritor operation suspended briefly after fresh catalyst additions to avoid excessive attrition of soft, fresh catalyst? Has anyone run into any kind of trouble in using such attritors?

ALEXANDER: A couple of years ago, our operators used the steam attritor to aid their circulation. We don't have any quantitative data, but any time you turned it on you could see catalyst coming out of the stack. We've found that 9 times out of 10 if we adjust aeration we can get circulation back without using the attritor. The attritor is just a good way to throw catalyst out the stack.

BANKS: Has anyone run into trouble with regeneration of spent catalyst because of loss of pore diameter? If so, what were the circumstances that caused the trouble?

HARRELL: There is trouble where sintering has occurred.

ADAMS: Our comment is similar. This sounds like what most of us call sintering (OGJ, Mar. 31, 1958, p. 85, and OGJ, Mar. 23, 1959, p. 107). I think it has also been called trapped carbon and other things. We had a severe case of sintering about 2 years ago and there was a definite correlation between pore volume and the sintering index.

Catalyst poisoning

BANKS: What is the effect of molybdenum as catalyst contaminant in cat cracking compared to nickel or vanadium?

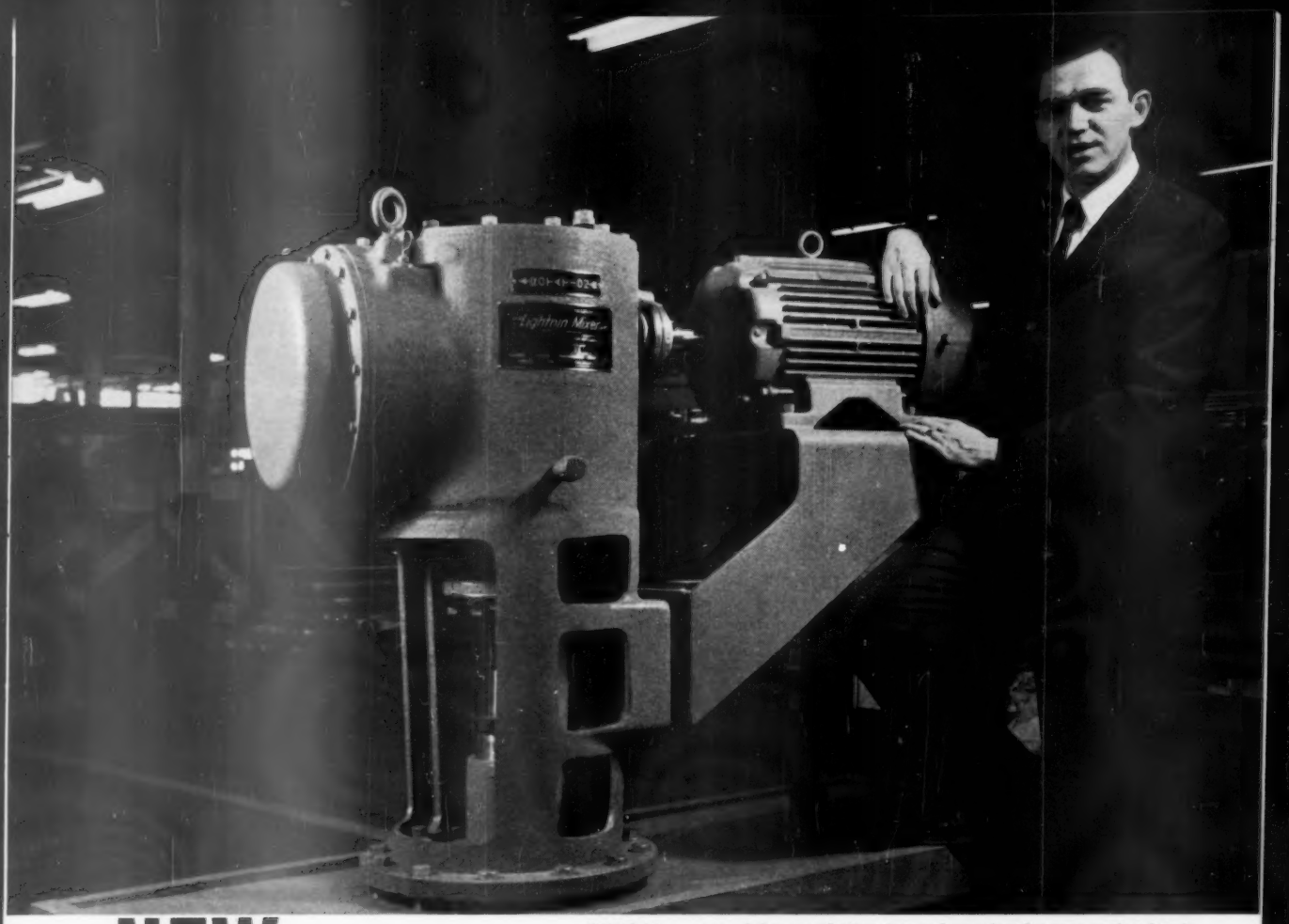
WRIGHT: It's not nearly as severe a poison as either nickel or vanadium. A cracking catalyst can apparently handle much more molybdenum than nickel or vanadium—probably three to four times as much.

BANKS: Is there any experience indicating that an electrical desalter removing metallic poisons from the cat cracker charge?

COLE, E. A. (Petreco Division): We have done some laboratory work on the problem and have had some success. In the March 1958 Petroleum Refiner, page 197, is an article giving limited data on nitrogen and metal-poison removal by the use of sulfuric acid and electrical precipitation of the acid sludge. An insignificant reduction in vanadium was noted and a fair reduction in iron content.

We have data that show we can remove a large percentage of the metal poisons from cat charge stocks. In some cases it would not be economical, in some cases it would be. Until we have more experience and data any application would require a detailed technical study.

We have little success in removing metal contaminates from the whole crude unless they are water soluble or in the form of solids. Arsenic can



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be removed fairly readily since it usually occurs in a water-soluble form, but vanadium and nickel are almost always tied up organically, possibly in a porphyrin-type compound, and cannot be removed by normal desalting techniques.

BANKS: What information is available on regenerative-type activity improvement of cracking catalyst poisoned by nitrogen? What is the theory of nitrogen poisoning?

ROSE: Two fairly recent articles on this subject can be found in the Petroleum Refiner of March 1958 and March 1959. The first is by Ken Wiland of Tidewater and the second by Samuelson and Woklflin of the Petrolite Corp.

MARDAGA: Nitrogen poisoning, unlike heavy metals contamination, does not cause permanent loss of activity or selectivity. It acts much the same as deactivation from high carbon levels. It is thought that nitrogen compounds picked up from nitrogen in feed are adsorbed on the catalyst and then burned off as coke during regeneration. If high-nitrogen feed is replaced the catalyst should recover its normal activity.

ALEXANDER: Regarding nitrogen being burned off in the regenerator, we removed a large portion from the refractory from our regenerator this year, and up in the plenum chamber the refractory had a very, very strong ammonia odor. Just how much ammonia got in there, I don't know, but at times it was enough to drive the men out of the working area.

Product distribution

BANKS: What is the effect of bad levels and temperatures in cat cracking on selectivities at constant coke-burning capacity?

RATLIFF: In lowering the bed levels of TCC airlift units, all other conditions remaining the same, we would naturally expect the conversion to be less. We would expect at the same conversion, slightly less gasoline and coke, and more dry gas. At the same coke level attained by higher temperature, there would be more gas and more barrels of gasoline produced at a lower efficiency.

We did about this same thing at our Lake Charles refinery. We built in capacity to attain approximately the same coke capacity or coke laydown. We achieved about the same conversion, with some incremental increase in gasoline yields, and a change in product distribution, primarily an increase in the olefins-to-saturate ratio in the C-4 and C-3 fractions. This was one of our primary objectives.

BANKS: What is the industry's experience as to the ratio of isobutane to butylenes in product from fluid cat cracking high recycle operation?

ROSE: I have the results of one sample which we took last week. We found a ratio of about 9 to 25 on a mole per cent basis. Throughput ratio was about 1.9 at the time of the sampling.

JOHNSTON: We ran a plant test sometime ago. Without recycle we had an isobutane-to-butylene-ratio of 0.85. When the throughput ratio was 1.15, the isobutane-to-butylene ratio was increased to 0.97, and at a throughput ratio of 1.45, the isobutane-to-butylene ratio was 0.96.

DANIEL: Based on our correlation work on commercial plant operations over a period of years, we've found considerably lower ratios with the high-recycle operation. What it really boils down to is that the butylene yield at a given conversion seems to be fairly independent of recycle ratio, but the isobutane yield drops quite rapidly with increased recycle. As an example, we would expect a reduction in isobutane-butylene ratio of 0.20-0.25, with an increase in recycle ratio from 0.5 to 1.0 at a constant conversion.

CHAMBERLAIN, J. P. (Delta Refining Co.): We seem to find that either Filtrol catalyst or Socony high-density has an effect on our isobutane. In other words, we've changed catalyst twice, and each time there's been some question as to which one we should use. It has almost boiled down to a selection based on the amount of isobutane we want. With Socony's high-density Durabead we don't have to buy outside isobutane. For the record, we are currently using natural catalyst.

HATTMAN: His observation is correct. With the natural catalyst, such as the Filtrol variety, you do make less iso-C_4 than you would with a synthetic catalyst such as the Filtrol variety. Socony Bead, of course, is a synthetic catalyst.

BANKS: High oil rates in the lift line of a fluid catalytic cracking unit cause excessive erosion necessitating either fresh feed or recycle being charged directly to the reactor. What differential yields would be expected from these alternates?

ROHLER, C. W. (Cities Service Oil Co.): We performed an experiment where we charged all the fresh feed direct to the reactor bed, bypassing the riser in a Kellogg Model A Orthoflow. Unfortunately we did not see any gain whatsoever in charging the fresh feed direct to the reactor after taking all the data and converting it back to a constant air rate.

ADAMS: This question refers to high oil rates in the lift line of a fluid unit, and I presume the author is referring to the oil riser to the reactor. We have this situation in one of our cat cracking units, wherein we charge our lighter gas oil directly to the riser of the unit and put the heavier material into the reactor bed through nozzles in the side of the vessel. Early this year we conducted a test run and for a few days, put the total feed directly into the riser. Data on the comparison of the test run under those conditions and a test run under normal conditions, are as follows:

	Bbl./day	Vol. %	Bbl./day	Vol. %
Feed to riser	20,811		27,901	
Feed to bed	7,055		0	
Products:				
Propylene	1,709	6.13	1,463	5.24
Propane	1,397	5.01	967	3.47
Isobutane	1,687	5.95	1,414	5.07
N-butane	610	2.19	581	2.08
Butylenes	2,524	8.96	2,291	8.21
Pentanes	3,167	11.36	3,237	11.60
C6-430° e.p.	9,767	35.04	10,207	36.58
Light cat cycle	7,249	26.01	7,033	25.21
Decanted oil	1,401	5.03	1,440	5.16
Conversion		68.96		69.63
Wt. recovery, per cent		103.19		101.68

Feed stock selection and treatment

BANKS: Do other refiners find any advantage in segregating feed (i.e., light virgin gas oil and heavy virgin gas oil) to different catalytic cracking units?

VERITY: Foster Wheeler has been offering catalytic cracking units with more than one reactor, to take advantage of this effect, not only in segregating different fresh feeds, but also

in cracking recycle, possibly even two recycles, under different conditions. We have some information on the best case which shows as much as 2% more gasoline. We should be very glad to hear any information obtained on a commercial scale, as much of our information is pilot-plant work. It seems to me—by analogy with thermal cracking—that any degree of segregation is better than mixing. It may be a diminishing return, and there is a point beyond which it isn't worth going.

ZANDONA: We have had some experience in the Ashland refinery at the time when we operated two TCC catalytic cracking units. We charged different feed stocks to each unit. One unit was operated on a once-through basis with light feed while the other unit was charged with recycle from the once-through unit, plus a heavy cylinder stock. We had certain advantages in that we could maintain higher catalyst activity on the once-through fresh-feed unit, maintaining a little better selectivity, lower coke and higher fresh-feed charge rate.

We were able to use catalyst rejected from the once-through unit into the other unit. We took advantage of the harder catalyst with the lower attrition loss in the recycle unit. The primary advantages were the lower catalyst consumption and the better product selectivity through maintaining a higher activity on the clean virgin stock.

BANKS: What are the advantages and disadvantages of coker gas-oil feed to a cat cracker as compared to a vacuum-flashed virgin feed?

VERMILLION: Ignoring the advantages and disadvantages, we have some data that compare the yields of the flashed virgin feed versus the coker gas-oil feed at the same cracking severity. We would expect, at the same cracking severity, to get 7% higher conversion on feed, 0.6% less coke, 0.5% less gas, 0.5% more butane, and 7% more gasoline, and I might note that the coker feed in question here is from a long resid.

ADAMS: The quantitative difference between coker gas oil and vacuum-flashed virgin gas oil certainly depends on the nature of the resid that was charged in the coker, and also, I imagine, on the type of coker itself. However, from a qualitative standpoint, we can verify that we find more coke, less gasoline, and less-desirable product distribution from gas oils from our coking units. Coker gas oils, are low in metals content as compared to vacuum gas oils.

BANKS: What have been the findings during the past year by users of Cronex "C"?

MADDOX, R. J. (Texas City Refining, Inc.): Our findings after a full year of operating two topping units, using Cronox "C" on both, can be categorized as follows: (1) Fouling of furnace tubes, and subsequent loss due to overfiring, has been arrested. (2) Fouling of crude exchangers has been greatly decreased, resulting in savings in maintenance costs due to ease of cleaning. (3) Corrosion caused by naphthenic acids, either alone or in conjunction with either sulfur or chlorides, has been greatly decreased. (4) No equipment has plugged due to the use of soda ash.

BANKS: What are the relative merits of propane deasphalting and coking for the production of cat cracker feed stock?

VERITY: I would like to tell you a little about some of the results we've had on propane deasphalting, using better methods of contacting the two streams, the oil and the propane. We have found that propane deasphalting is a bit like distillation—you need a lot of transfer units, and using the Shell rotating-disc contactor (RDC) in our pilot plant, we've had some phenomenal results. You not only have to have an adequate number of transfer units, but you also have to have the proper temperature conditions. As an example, we've been able to take residue from a Venezuelan crude, having over 700 p.p.m. of vanadium, and get a product below 1 p.p.m., and with really quite phenomenal yields of good cat cracking charge stock.

We're preparing a booklet on our results comparing propane deasphalting with coking. We feel that propane deasphalting is going to come back in quite a big way for getting the most out of the crude barrel. Some of the asphalts we've made are as high as 1.1 specific gravity. There is not only zero penetration, but some are like little pieces of rock; it is an absolutely solid material.

BANKS: Who is hydrogenating coker gas oil or cat heavy gas oil (decanted oil) and what effect does this have on the cat cracker?

OLESZKO: Aurora has been hydrogenating fluid-gas oil. This gas oil is much heavier, and presents a few more problems in cat cracking and also in hydrogenating. It ranges upward to 1,100° e.p. and 2.5-4% Conradson carbon. We have run the fluid-coker gas oil both ways, hydrogenated and straight. When you hydrogenate it, you have problems in that there is an excess of metals depositing on a cobalt moly catalyst, which deteriorates the catalyst. In direct cat cracking, metals deposit on the catalyst.

There is also another problem when you cat crack without hydrogenating, i.e., the high Conradson carbon. You have to reduce conversion in order to be able to run it. We are currently running the coker gas oil in the cat cracker unhydrogenated. The coker gas oil I'm referring to here contains 2.5-3.0% sulfur.

ROSE: At Delaware City, our heavy coker gas-oil charge to the cat cracker is not hydrogenated.

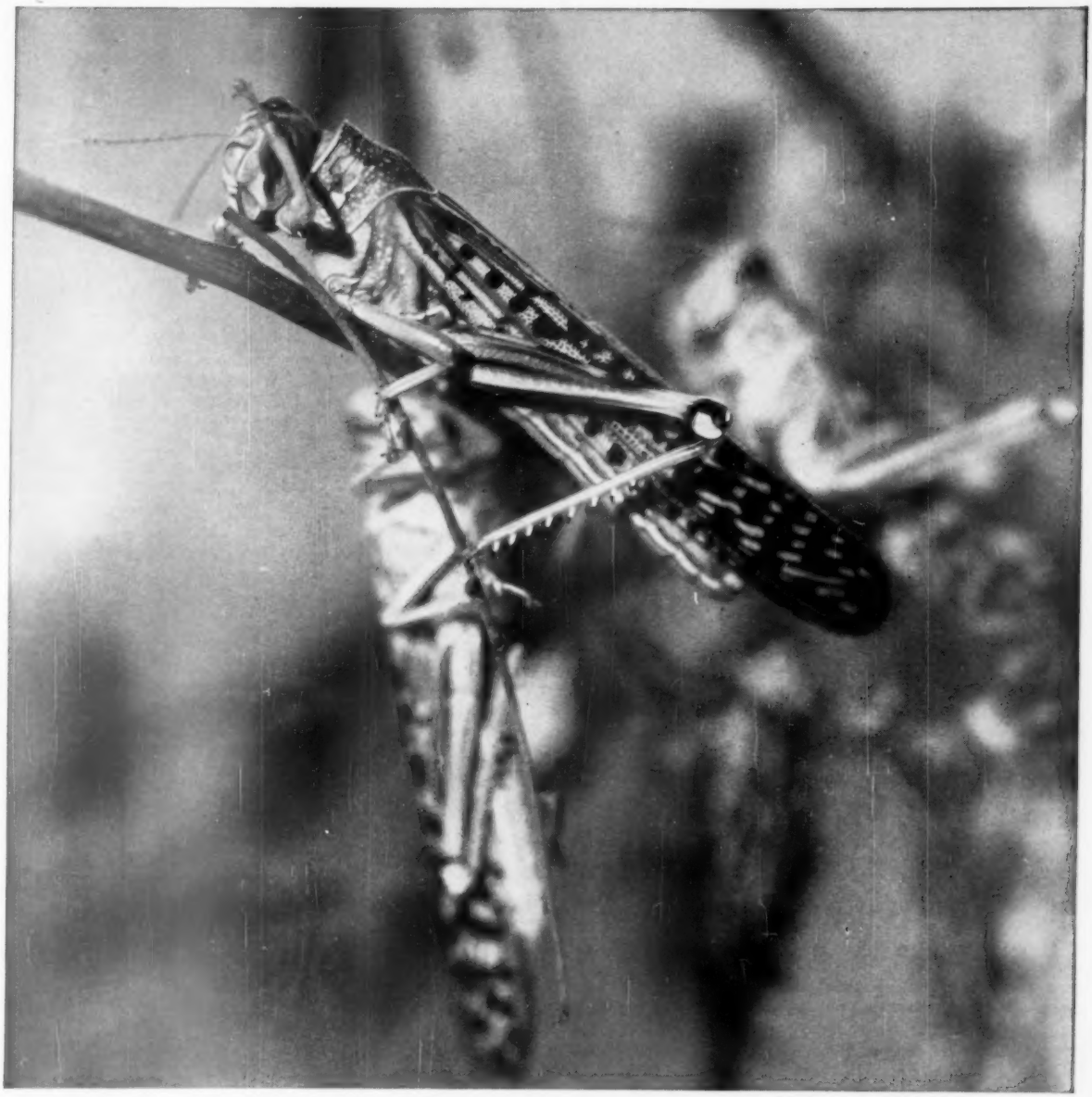
VERITY: This has to do with high-recovery light-ends plants. I have noticed, from results I've seen from several units, that the inerts content of the absorber offgas varies all over the map. Where the units are using gas or steam for reactor aeration and reactor bleeds, I am wondering if anyone has an idea what would represent an attainable low level of inerts in the offgas from an 80 to 90% C_3-recovery operation. By inerts, I mean nitrogen, and carbon monoxide, and carbon dioxide.

ZANDONA: We made a study concerning the air bleeds in our reactor, and have installed natural-gas bleeds in preference to air. The nitrogen content of the absorber offgas to fuel is about 8 to 11% with high C_3 recoveries. We recently put into operation a new gas-recovery plant and we are obtaining 90 to 92% propane-propylene recovery.

O'NEILL, J. A. (Ingram Oil & Refining Co.): Mr. Rose, will you comment a bit more on this effect of recycling light-cycle oil. Was the change in end point accompanied by no change in product distribution among the products heavier than gasoline? Was there any change in the quality of the heavy-cycle oil, or the decanted oil?

ROSE: To the best of my recollection, the answer to both of these questions is no. I don't think we noticed, within the limits of our ability to determine yields, any difference in yield or characteristics.

O'NEILL: We'd like any information that anyone can give us on any way of changing product distribution of the products heavier than gasoline in a cat cracker. I'd like to run at the same conversion and make more light-cycle oil and less heavy-cycle oil.



SUNBURY-ON-THAMES, ENGLAND

Locust hordes reported! Place – the BP Research Centre at Sunbury-on-Thames. Here scientists are busy breeding and killing the insects to test new solvent oils which will provide even more effective bases for insecticides.

BP

DANIEL: The primary way to do that would be to run a higher recycle-rate operation. An increase in two or three-tenths in the recycle ratio would give a 2% increase in cat light-gas-oil yield, with a corresponding decrease in heavy-cycle yield. This would be for a constant-pour-point cat light gas oil. The cat light gas oil 90% point would decrease, perhaps 10°-15° F.

ZANDONA: Whenever we want to increase light-cycle oil yields, the first thing we do is increase recycle ratio and lower reactor temperatures.

DANIEL: Have many people run successfully for a period of time with main column bottoms temperatures over 710° F., without coking in the bottom of the tower?

ROHLER: We have operated our main tower bottom with a temperature of 720° F. for a period extending over a month.

ROSE: We've run for a year now with fractionator bottom temperatures at or about 720°.

ALEXANDER: We flux the bottom of our main column to keep that below 650°. It is a combination tower on reduced crude, but on the vapor to our first bubble tray, and the liquid from the first bubble tray, from the bottom, are run at 770°-780°, and we get a year's run out of it. The temperature of the vapor to our heavy-cycle drawoff runs about 720° F.

EPPARD: In 1943 the Duncan unit was run at around 720° main column bottoms temperature. We first had quite a bit of coke forming, but that was because there was a lot of hardware inside. Once that was taken out, we didn't have any more problems.

Feed stock analysis

BANKS: What tests are used to correlate cat cracking feed stocks, i.e., 50% point (per cent off at 700°)?

ADAMS: We are presently in the midst of an extensive study to attempt to correlate yields from a variety of cat cracking feed stocks. We want to determine the individual yields from various stocks charged to our cat cracking units when added as additional feed. We have engaged a consulting outfit to assist us with this. Here are the variables we're using for correlating parameters on these feed stocks: API gravity, distillation curves, carbon residue, viscosity, aniline point, pour point, per cent of sulfur and nitrogen, Bromine number, metals content, and refractive index.

VERITY: How much success have you had so far in pulling together so many variables? It seems as though it would be almost impossible to get a correlation which would really be applicable.

ADAMS: Using carbon residue, the correlation is with coke production. Gravity, aniline point, refractive index are combined for an approximate estimate of the paraffins, naphthenes and aromatics in the stock. The bromine number will measure olefins in cat feed stocks such as coker stocks. Per cent sulfur and nitrogen will correlate with nitrogen poisoning of the catalyst and sulfur distribution. Metals content will give us some idea of the poisoning of the catalyst.

The program is rather ambitious, and it's been under way for 4 or 5 months. It will eventually involve a computer program which will take extra feed stocks on paper as potential additions to our cat unit and calculate by a balance around the existing unit, considering its limitations, the incremental contribution these feed stocks have to the over-all yields to the unit. We can then determine their particular value as additional charge stocks. This is a point that I know is of great interest to every operator of a cat cracker, and usually very hard to come by, using normal hand calculation means.

JOHNSTON: How do you plan to test the results of your correlation?

ADAMS: That is one of the beauties of the computer program. It's impossible to argue with. Of course, we can make comparisons between the over-all yields calculated by computer and observation of over-all yields on the units themselves. However, it will undoubtedly be impossible to determine, for example, the accuracy of a calculated contribution on an additional 50 bbl. of, say, a lube extract as an incremental feed. Even though this will be impossible to confirm, we think it will be better than the guess work we're using on this type of estimate today.

MASOLOGITES, George (Atlantic Refining Co.): We spent a lot of time correlating cat cracking data, and we've pretty well decided that you have to handle the virgin stocks separately from stocks which have undergone other types of treatment such as cat or thermal cracking. The most success we have had, particularly on the cat stocks, is to use a criterion of weight per cent hydrogen in the feed stock. Hydrogen content can be obtained directly or predicted from refractive index, gravity, and molecular weight. We find this typifies the stocks quite nicely.

We have had difficulty translating this over to virgin feed stocks, although it will work on extreme stocks such as wax. It is difficult to typify stocks. We've decided that the only real answer is to analyze the feed stock for aromatics, naphthenes, paraffins, the number of rings in the aromatics, etc. We plan an experimental program to do this.

BANKS: Are you using a computer that you can't argue with? Do you believe the computer only in part?

MASOLOGITES: We use two approaches. We use man-developed correlations when the data may show a minimum deviation trend one way. The man doesn't necessarily believe the trend and insists on the experimental data adding up to a logical answer. We use a computer extensively, but frequently question the results. We have come up with some unlikely trends using the computer and find it necessary to modify them.

I believe the computer only in part. When you take three or four hundred selected test runs and feed them into the computer it grinds away and presents you with some trends. Frankly, I think that where specific programs were carried out, a variable should be taken out separately, looked at in the computer and then checked against the final result. I believe that the component parts of a correlation should check reasonably well with the whole. The computer is a good tool for large-scale correlation work, and is used to the best advantage when process study and mathematics are combined.

ADAMS: We feel the main fault with traditional cat cracking correlations is that they assume that if you add additional feed stock, you get conversion from that stock at the same level as the conversion of the average feed to the unit. Obviously this isn't true. If you add a refractive feed stock, very likely that material will crack only 20, 30, or 40%.

It is hard to determine, but depending on the average unit conditions the majority of this material may wind up in the recycle, and in effect back out recycle cracking that was going on before you put it in. The intent of our program is to determine what actually happens to each feed stock.

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Putting linear programing to work

. . . on a refinery optimization program

Part 1 of this series outlined the solution technique in general terms. A sample problem was worked in detail in Part 2. Part 3 tells how Continental went about its first linear-programing study of a complete refinery.

PART 3—CONCLUSION

BY JOHN E. CHENEVEY
Continental Oil Co.

THE OPTIMIZATION of one of Continental Oil Co.'s smaller refineries was the first linear-programing study of a complete refinery undertaken by the company. While the study was primarily a learning effort, the results have helped to guide our thinking in certain areas of refinery operation. And it has been invaluable in preparing our process engineers and mathematicians to program more complex refineries. Here is a step-by-step explanation of how this program was set up.

Every refinery must be approached on an individual basis, and the first task is to compile reliable operating and yield data. This initial work should give the engineer a feel for the problem. However, due to the problem-size limitation on the IBM 650 computer, it is usually necessary to estimate approximate levels for some of the variables.

For example, if it is known that the TEL level of a gasoline will be between 1.5 and 3.0 ml. per gal., the range from 0.0 to 1.5 ml. per gal. need not be included in the problem, thus saving room in the computer for including other factors.

Likewise, it is necessary to decide which factors are important and which factors can be omitted. Usually some preliminary computer runs are required to evaluate, and if necessary improve the assumptions made in initially setting up the problem.

Since this refinery was relatively uncomplicated, it was possible to include nearly all of the important variables in a problem fitting the size limitations of the IBM 650 computer.

Fig. 6 is a schematic diagram of this refinery as programed for the study. Each of the solid dots indicates a place where a blending stock is produced. Butane is produced from more than one unit. The open circles indicate points of flexibility where a decision must be made.

Fig. 7 shows the permissible modes for blending base stocks into various products. These two diagrams represent flows of material. These are expressed mathematically in the restrictions in the linear-programing problem statement.

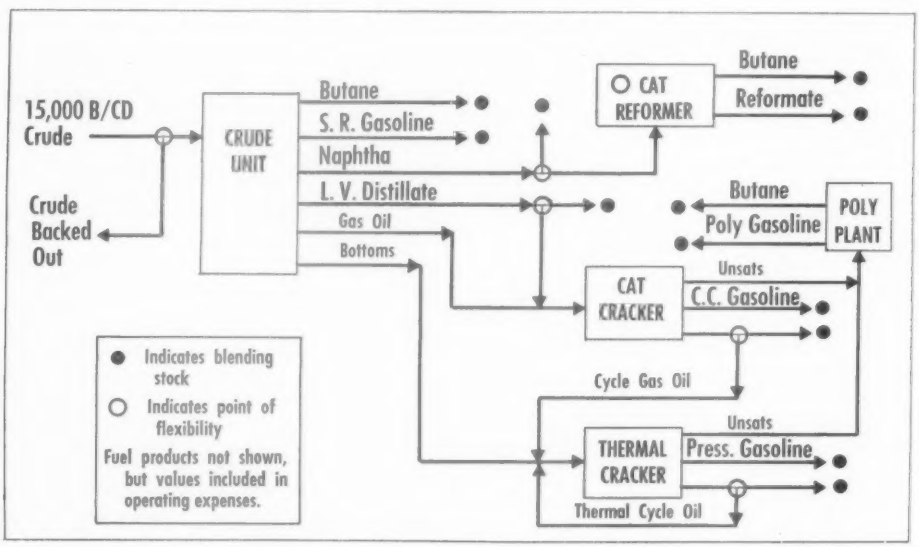
The first answer required is the optimum crude rate. The problem was set up on the basis of the maximum crude rate of 15,000 bbl. per calendar day with lower crude rates indicated by the amount of crude backed out. This method of handling crude rate is desirable, since we know that optimum operation will be near maximum throughput.

The computer must also determine how much naphtha should be blended to jet fuel and how much should be charged to the catalytic reformer. Furthermore, since operating the reformer in blocked-out operation at two different severities is usually preferable to operation at a single severity, the linear program must determine separate charge rates and reforming severities for the two types of operation.

Another decision which must be made is how much of the light virgin distillates should be blended to heating oils and how much should be charged to the catalytic cracker. Due to problem-size limitations, cracking severity could not be included as a variable. Cycle gas oil can be either blended to heating oil or thermally cracked and thermal cycle oil can be either recycled or blended to fuel oils.

Fig. 6 shows how the refinery can be operated, and Fig. 7 shows the ground rules for blending various products. Note in Fig. 7 that the linear program will also specify optimum TEL contents for both regular and premium gasolines.

With the linear-programing approach it is possible to orient the re-



SCHEMATIC diagram of one of Continental's small refineries. Fig. 6

finery operation directly in terms of the market situation. Market demands and sales prices for the various products are entered into the problem. The computer is then asked how to operate the refinery for maximum profit in view of the specified sales potential.

The linear program is asked to make innumerable decisions, most of which are interacting, in such a way that all material balances are satisfied, product specifications are met, and at the same time yield maximum profit. This is a pretty big order.

It is important to remember that the problem solution might indicate instances where it would be more profitable not to completely fulfill a market demand. This might occur, for example, if the demands for gasoline and distillates are badly out of balance. It is also possible to force the solution to meet any market demand. And a direct comparison of profit between cases, when meeting the demand fully or optimally, will provide the basis for a decision.

The refinery was formulated using 38 restrictions and 40 real variables, which completely filled the basic IBM 650 computer. Basic data, which are more or less fixed for a given refinery, are included in the coefficients of the restrictions. More variable data, such as market demands, market prices, crude-oil prices, and operating costs are in the quantity factors of the restrictions and in the coefficients of the profit equation.

After a solution is obtained, it is possible to change either a quantity factor or a profit coefficient and obtain a new solution in just a few iterations without starting the problem completely over.

Procedure

The 38 restrictions used are shown in Table 1. Material-balance restrictions are required on all products and all blending stocks. Catalytic reformate is an exception which does not require a separate material-balance restriction, since it is tied in with the gasoline and naphtha material-balance restrictions.

Material-balance restrictions assure that no more of any material is used than is actually produced, or that no more of any product is produced than can be sold. Product material-balance restrictions also indicate the amounts of the products that can be sold. Material balances on products and blending stocks used up 18 of the 38 restrictions.

Another five restrictions are used to set certain availability limits and some equipment-capability limitations. The casing head was assumed to be purchased, and a restriction was needed to specify how much might be available. A restriction was required to limit the amount of light virgin distillates charged to the catalytic cracker in order not to exceed its capacity.

Another restriction was required to designate the maximum amount of thermal-cycle oil that could be blended to fuel oil if none is recycled. This restriction puts a limit on the capacity of the thermal cracking unit.

Finally, two restrictions were required to set up a "cookbook" composition requirement for jet fuel. Using such a composition formula rather than property specifications uses less space in the computer. The jet-fuel composition requirement specified a minimum light virgin distillate and a maximum light virgin distillate plus thermal-cycle oil content.

The remaining 15 restrictions were used for blending the two gasolines to meet specifications and also select optimum TEL levels. Restrictions are required to specify R.v.p. and the two distillation points for each gasoline. Determining the optimum lead level requires four restrictions for each gasoline, and this only covers a possible TEL range of 1.5 ml. To cover the full range of 3.0 ml. would require seven restrictions for each gasoline.

Finally, one restriction was added to assure that the sensitivity of pre-

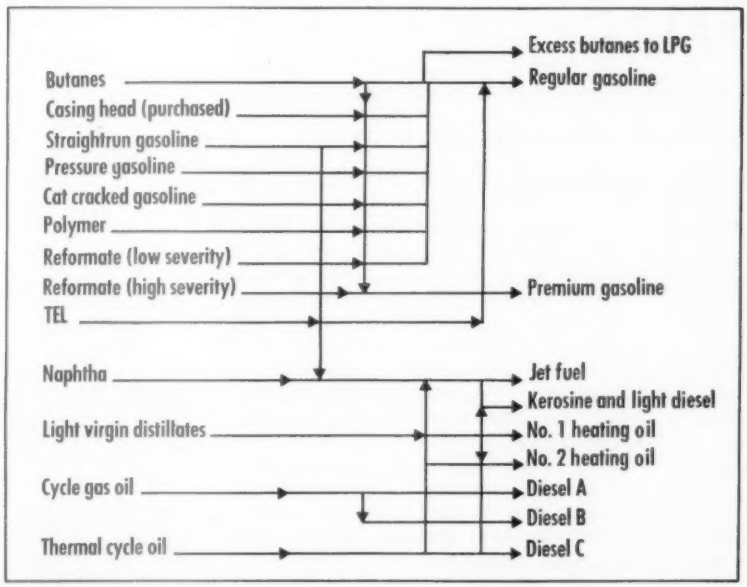
TABLE 1
Restrictions in Refinery Linear-Programing Study

Eighteen material-balance restrictions:
- Butane
- Straightrun gasoline
- Naphtha
- Pressure gasoline
- Catalytic cracked gasoline
- Polymer gasoline
- Light virgin distillates (LVD)
- Cycle gas oil
- Thermal-cycle oil
- Regular gasoline
- Premium gasoline
- Jet fuel
- No. 1 heating oil
- No. 2 heating oil
- Kerosine and light diesel
- Diesel A
- Diesel B
- Diesel C

(No material balances on catalytic reformates)

Five limits on components and compositions:
- Casing-head availability.
- Thermal-cycle oil availability
- Maximum light virgin distillates to cracking
- LVD plus thermal-cycle oil in jet fuel
- Minimum LVD in jet fuel

Fifteen quality specifications on gasoline:
- Seven for regular:
  - One R.v.p.
  - One maximum over at 130° F.
  - One maximum over at 200° F.
  - Four research octane (only 1.5 ml. TEL range)
- Seven for premium (similar to regular)
- One sensitivity difference between premium and regular



BASE STOCKS can be blended into various products by these routes. Fig. 7.

ASSIGNMENT: CORROSION

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mium gasoline was not more than three octane units greater than the sensitivity of regular gasoline.

Material balance. The material balance type of restriction will be illustrated for the case of naphtha since this restriction involves the catalyst reformer.

This restriction is: 3,500 − 0.232 crude backed out = slack + 1.107 Ref.-92R + 1.126 Ref.-94R + 1.147 Ref.-96R + 1.173 Ref.-98R + 1.205 Ref.-100R + 1.147 Ref.-96P + 1.173 Ref.-98P + 1.205 Ref.-100P + 0.5 jet fuel where the units are bbl. per calendar day and the notation Ref.-92R refers to reformate of 92 octane with 3 ml. TEL for blending into regular gasoline. Ref.-96P means reformate of 96 octane with 3 ml. TEL for blending into premium gasoline.

The two terms in the left-hand side of this equation determine the production of naphtha, while the terms in the right-hand side determine how the naphtha is used.

The yield of naphtha for the maximum crude rate is 3,500 bbl. per day and, in case the optimum crude rate is less than maximum, the second term corrects the base yield for any crude backed out. On the right-hand side of the equation is the slack variable. It represents naphtha which might be produced but not used.

The next five variables are concerned with the reforming severity when making regular gasoline. The linear program will select the optimum reforming severity from the specified range of 92 to 100 octane with 3 ml. TEL. The solution may indicate a single quantity of reformate at a single severity or may indicate separate quantities of two adjacent severity reformates.

For example, if the answer indicated 1,500 bbl. per calendar day of 96-octane and 500 bbl. per calendar day of 98-octane reformates, the reformer should be operated to produce 2,000 bbl. per calendar day of 96.5-octane product.

The coefficients on these terms are reciprocals of the yields and indicate how many barrels of naphtha are required to produce 1 bbl. of specified reformate. For example, the coefficient 1.107 means that 1.107 bbl. of naphtha are required to produce 1 bbl. of 92-leaded-octane reformate.

The next three terms are similar to those discussed above except that they apply to reforming for premium-gasoline production. The final term provides that any jet fuel produced will contain 50% naphtha. Together, these 10 terms account for all of the naphtha produced.

Composition. The next example is a composition on jet fuel. This requirement states that the sum of the light virgin distillate and the thermal-cycle oil in jet fuel shall be exactly 38%. This restriction in terms of bbl. per day and in the order that it appears in the matrix is: 0 = slack + LVD to jet fuel + TCO to jet fuel − 0.38 jet fuel produced.

This equation might be easier to understand if the last term is transposed to the other side. The requirement is for a definite composition rather than a limiting value, hence the slack is really an artificial variable and must be forced to zero by assigning it a large negative coefficient in the profit equation.

Quality specification. The following restriction is typical of a blending to meet quality specifications. R.v.p. will be used for illustration, and this particular restriction was written for a specification of 11.7 maximum R.v.p. for regular gasoline.

0 = slack + 65.3 butane − 4.7 straightrun + 4.3 casing head − 7.2 pressure gasoline − 6.3 catalytic cracked gasoline − 9.6 polymer − 9.0 Ref.-92R − 8.9 Ref.-94R − 8.8 Ref.-96R − 8.7 Ref.-98R − 8.7 Ref.-100R.

The units in this equation are barrels per day, and the coefficients are the difference between the component R.v.p., and the specification R.v.p.

For butane, for example, this coefficient is 77.0 − 11.7 = 65.3. This difference must have the proper algebraic sign to correspond to whether the specification represents a maximum or a minimum.

The rule is that, if the component meets the specification, the sign is negative. If it does not meet the specification, the sign is positive. Butane does not meet the 11.7 maximum R.v.p. specification, therefore its coefficient must be positive.

This type of restriction is written in terms of balancing out the over and underspecification components to zero. This must be done rather than equating total R.v.p. barrels to total permissible R.v.p. barrels because the total number of barrels of product that will be made is not known if a product is shorted. There are also some computation advantages for having the quantity term of the restriction with zero value.

It should also be pointed out that components which are permissible in a blended product are designated by including corresponding variables in the blending and material-balance restrictions for that product. Components corresponding to variables which do not appear in these restrictions cannot end up in the product. Also, as in the case of the material-balance restriction, only one or at most two adjacent severity reformates will be used.

The slack in the above restriction represents R.v.p. barrels below the permissible maximum. If the slack comes out zero it means, of course, that the blend is exactly 11.7 R.v.p. If the slack has some positive value the R.v.p. of the blend can be calculated from the relationship: slack = total barrels of blend × (11.7 − R.v.p. of blend).

Octane specification. The method for blending to meet octane specification becomes more complicated because the linear program is also required to determine the optimum TEL level. Several restrictions are required to define the situation completely.

For illustration, consider blending regular gasoline to an 88.0 minimum research octane level. The first restriction in terms of barrels per day is: 0 = slack − 8.5 butane + 18.2 straightrun + 17.2 casing head + 16.4 pressure gasoline + 0.2 cat-cracked − 7.8 polymer + 7.8 Ref.-92R + 4.4 Ref.-94R + 1.2 Ref.-96R − 2.0 Ref.-98R − 5.0 Ref.-100R − 1.0 (ON bbl. 0.0-0.5) − 1.0 (ON bbl. 1.0-1.5) where the coefficients associated with the components are 88.0 − (clear ON of component).

Note that the coefficients are obtained from clear octanes of the components, and the signs are such that a negative coefficient indicates a component which meets the 88.0 ON minimum specification. A positive coefficient indicates a component which does not meet specification. Again, the unders and overs are balanced out to zero.

The slack term in this restriction represents total octane-barrels above the minimum requirement. The next 11 terms indicate the excess or deficiency of octane-barrels from specification that results from blending clear gasoline components. This clear blend provides the cheapest octane-barrels, and these will always be used first.

The third from last term shows that, in case sufficient octane-barrels are not obtainable from the clear blend, additional octane-barrels are available at a somewhat higher cost by adding 0.5 ml. of TEL to the blend. The exact number of octane-barrels made available by adding 0.5 ml. TEL to the clear blend has to be specified in another restriction.

Similarly, the next-to-last term provides that in case sufficient octane-barrels cannot be obtained at the 0.5 TEL level, additional octane-barrels are available at a still higher cost,

since the lead susceptibility decreases with increasing lead level, by increasing TEL level from 0.5 to 1.0 ml. And the last term provides the same option for increasing TEL level to 1.5 ml.

Similar terms could be added taking the TEL level stepwise up to the 3.0-ml. limit. However, in the present case, space in the computer was limiting, and it was found from preliminary trials that the TEL would fall in the range 0.0 to 1.5 ml. per gal.

The effect of this restriction is that the linear program first determines what octane level can be reached without TEL, then picks up additional octane by adding TEL from linearized 0.5-ml. steps until the octane specification is met. Throughout this calculation the linear program is constantly balancing the cost of octane-barrels among TEL level, reforming severity, and blending scheme in order to produce the maximum profit.

There is a little trial and error involved in this calculation. It is necessary to insert the cost of octane-barrels for the various TEL level increments into the profit equation. These costs, of course, depend on the lead susceptibility of the final gasoline. Since the exact gasoline composition is unknown until the answer is obtained, the problem must be set up on the basis of an assumed susceptibility curve.

After a trial answer is obtained, the actual susceptibility and resultant cost is determined and compared with the assumed cost. If they are different, the new calculated cost is inserted in the cost equation and a second solution obtained.

The second calculated cost is compared with the cost used and the cycle repeated as required until these costs check. This cost adjustment is done automatically by the computer program and takes only a minute or so of computer time.

The three restrictions which specify how many octane-barrels can be obtained by adding TEL in the three 0.5-ml. increments from 0.0 to 1.5 ml. are similar and will be illustrated by the restriction for the interval 0.0 to 0.5 ml. TEL per gal. in regular gasoline.

This restriction, in units of barrels per calendar day is: 0 = slack − 3.9 butane − 6.4 straightrun − 6.2 casing head − 4.5 pressure gasoline − 3.4 cat cracked gasoline − 1.5 polymer − 4.8 Ref.-92R − 4.2 Ref.-94R − 3.9 Ref.-96R − 3.4 Ref.-98R − 3.0 Ref.-100R + 1.0 (ON bbl. 0.0-0.5) where the coefficients are the octane increases for components going from 0.0 to 0.5 ml. TEL per gal.

The limiting restriction consists of 11 terms with negative coefficients which are balanced against two terms with positive coefficients. The sum of the negative terms specifies the number of octane-barrels that can be obtained by adding 0.5 ml. TEL to the gasoline. The last term transfers all or part of these octane-barrels to the general octane restriction.

If all the octane-barrels are transferred, the slack will be zero; if only part are transferred the slack will be a positive number. This represents octane-barrels available in the TEL interval but not used. In any event, the last term represents octane-barrels in the TEL interval which are actually used.

As stated previously in discussing the general octane-blending restriction, the linear program first uses all the available unleaded octane-barrels, then picks up additional octane barrels by adding TEL in 0.5-ml. increments until an interval is reached where some excess octane-barrels are indicated. The optimum TEL level is then somewhere within this last interval.

For illustration, assume that TEL level falls within the 1.0 to 1.5-ml. interval. The exact TEL level, assuming linearity within the interval, will then be given by: ml. TEL = 1.0 + 0.5 (ON bbl. 1.0-1.5)/(ON bbl. 1.0-1.5 + slack).

This limiting equation also furnishes some of the data for calculating the cost per octane-barrel within this TEL interval, again assuming linearity within the interval.

This relationship is:

$$\text{TEL cost per ON bbl.} = \frac{(\text{Cost of 0.5 ml. TEL per bbl.})\ (\text{total bbl. blended})}{(\text{ON bbl. 1.0-1.5} + \text{slack})}$$

Sensitivity. The last restriction imposed on the gasolines was one on sensitivity. The requirement was that sensitivity of the premium gasoline should not be more than 3.0 octane units greater than the sensitivity of regular gasoline. This restriction was inserted as a stop-gap method, in view of limited space in the computer, for preventing any freak blends which might not be satisfactory gasolines. The way this restriction is developed will be described in detail to indicate how almost any requirement may be developed into the standard form for use as a restriction in a linear programing problem.

The basic requirement may be expressed: sensitivity of premium − sensitivity of regular $\leqq$ 3.0.

For the first approximation, assume that the sensitivities of components in the gasoline remain constant regardless of TEL level or blend composition. If this is not a good assumption, more accurate sensitivity coefficients can be used after preliminary runs indictate approximately how the gasolines will be blended.

To save space, only three components will be carried through the development of this restriction. Actually, of course, all components must be included. In units of barrels per calendar day, the requirement can be expressed in terms of the individual component sensitivities:

$$\frac{(0.0\ \text{straightrun P} + 14.0\ \text{polymer P} + 9.5\ \text{Ref.-100P})}{\text{straightrun P} + \text{polymer P} + \text{Ref.-100P}} - \frac{(0.0\ \text{straightrun R} + 14.0\ \text{polymer R} + 9.5\ \text{Ref.-100R})}{\text{straightrun R} + \text{polymer R} + \text{Ref.-100R}} \leqq 3.0$$

where the coefficients are the sensitivities of components, and P and R refer to premium and regular gasolines.

In this problem the volume of regular gasoline is always (unless one of the gasolines is shorted, which is highly unlikely) three times the volume of premium gasoline.

Making this volume substitution, clearing fractions, inserting the slack, simplifying, and rearranging transforms the restriction to the usual form: 0 = slack − 9.0 straightrun P + 33.0 polymer P + 19.5 Ref.-100P − 0.0 straightrun R − 14.0 polymer R − 9.5 Ref.-100 R.

Almost any condition can be set up as a restriction in a linear-programing problem. The restrictions are the ground rules that must be followed as every point in the solution and can never be violated. However, accurate data and realistic requirements must be used.

Acknowledgment

This work on refinery optimization was a joint effort between Continental Oil Co.'s process engineering and mathematical analysis groups, with the assistance of Bonner & Moore Engineering Associates. Their cooperation is gratefully acknowledged.

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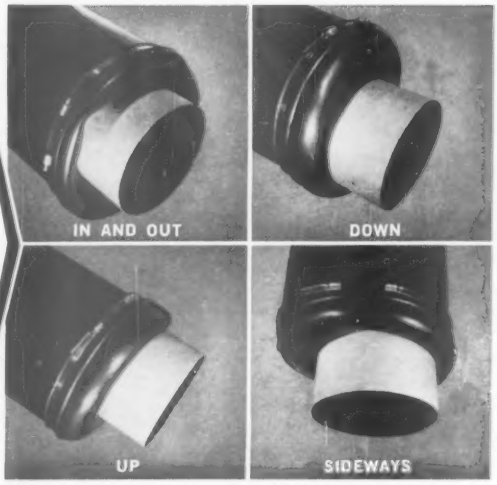

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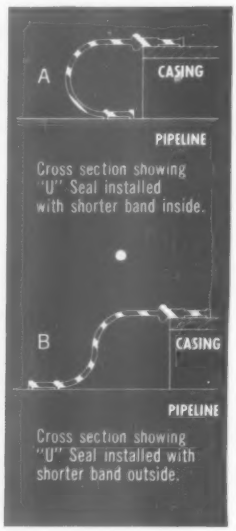

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BY T. A. FERGUSON
Senior Welding Engineer,
Transcontinental Gas Pipe Line Corp.

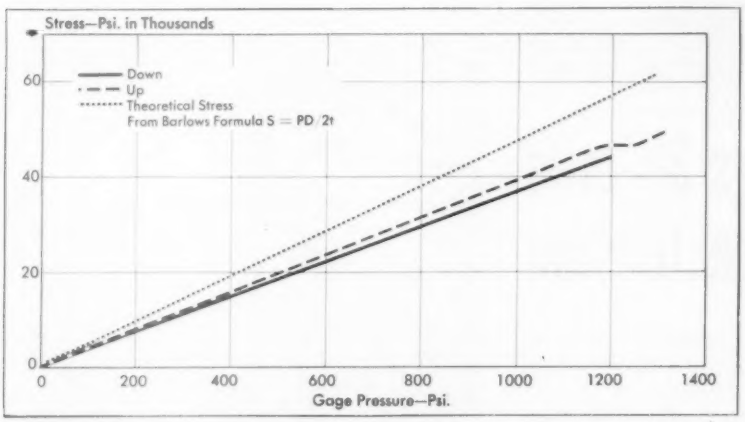
A PROGRESS REPORT on recent tests of welded repairs made on 5LX52 cold-expanded pipe shows the value of proper procedure.

Referring to the manufacturing specifications, welded repairs are allowable on defects when the depth does not exceed 33⅓% of the tabulated wall thickness and where the length of that portion of defect that exceeds 12½% is not greater than 25% of the tabulated outside diameter of the pipe.

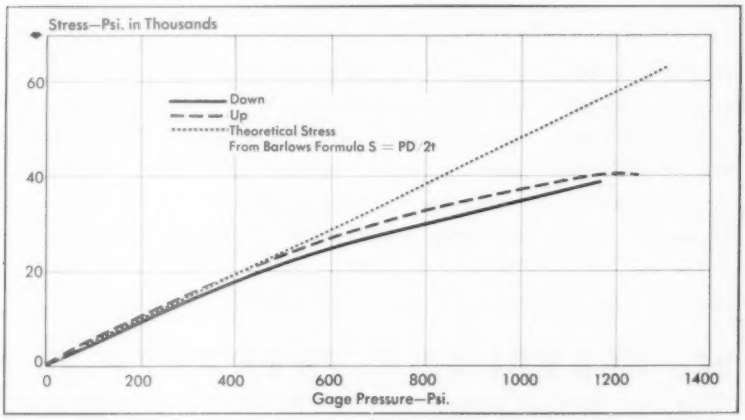
The repaired areas must be hydrostatically tested to 90% of the specified minimum yield strength. Only one repair is allowed along a length equivalent to 10 times the outside diameter of the pipe. The problem confronting an operating company is whether welded repairs made to defects on pipe in service will withstand all of the tests required by the specications; also, could the limits of these specifications be broadened so as to allow these repairs with the assurance of obtaining a quality weld repair?

This would obviously be a great savings in money if the defective material could be repaired instead of replaced. If a repair were made to a defect on an existing line, all of the tests required could not be carried out, i.e., the retesting of the piece to 90% of the yield strength.

From a paper presented before American Society of Mechanical Engineers, Houston.



PIPE 1, GAGE 2 data from testing repair of circular pit 1 by 1 by 0.220 in. deep; well before repair, 0.111 in.; after repair, 0.331 in.



PIPE 1, GAGE 2 data from testing repair of elliptical pit 1 23/32 by 1 11/32 by wall before repair, 0.111 in.; after repair, 0.331 in.

The minimum yield strength of cold-expanded X52 line pipe is achieved due to the cold working effects from cold expansion. Heat treatment can remove this increase in mechanical properties due to the cold working effects.

This, therefore, poses several questions regarding welded repairs on this pipe. What effect does the high temperature from welding have on the cold-worked mechanical properties? What is the degree and effect of welding stresses in the repaired areas? What effect does the depth or area of the repair have on the first two questions?

To answer these questions completely, considerable investigation and research is required. The size of the defect itself is a very important factor involving two channels of investigation. First, the original question as to the effect of the welding stresses for a given area and secondly, what size defect actually does reduce the yield strength of the pipe.

The seriousness of a notch has been brought out by past research and reports. However, it is apparent that at some point, the area of a defect will be such as to reduce the yield strength of the material causing a failure. Below this point, the defect may contain enough structural support around it, thus eliminating the danger of a rupture.

The tests that were performed were made on 30-in. o.d. by 0.325-in. wall 5LX52 line pipe. Three separate tests were run on three different lengths with welded repairs being made on two joints, and the third joint was subjected to a hydrostatic test without any repairs. This pipe had been in service for 9 years and was replaced due to excessive corrosion. All of the defects on the three test joints were natural corrosion pits.

Cleveland 140 digs 38-mile Idaho gas extension

Massart Construction Company of Spokane, Wash. used a Cleveland 140 to dig a 38-mile gas line eastward from Moscow, Idaho to serve a new refractory at Boville, another brick plant at Deary and smaller users along the line. The Cleveland dug the line 40 inches deep for 4 and 6-inch pipe at a rate of better than 2 miles per day.

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TABLE 1—REPAIRS ON JOINT NO. 1

Repair No.	Description of repair
1	Pit was circular, 1-in. diameter by 0.220 in. deep, on outside wall, welded and ground flush.
2	Pit was elliptical, 1 23/32 in. by 1 11/32 in. by 0.281 in. deep on outside wall, welded and ground flush.
3	Pit was elliptical, 1 20/32 in. by 1 12/32 in. by 0.305 in. deep, on outside wall, welded and ground flush.

Test on Joint No. 1

This joint contained three corrosion defects on it as described in Table 1.

The welding was done using a 5/32-in. low-hydrogen-type electrode. Sufficient weld metal was deposited so that after grinding the area smooth, no notches were left on the edges due to undercut or bead shapes. The grinding was done so as to, as nearly as possible, restore the original contour of the pipe wall.

Baldwin SR-4 strain gages were applied to the repaired areas in an attempt to obtain information with regard to the individual stresses occurring in each area. The gages were of the single-element type, placed to give the strain in a circumferential direction. A gage was placed on a sound portion of the pipe for comparison.

Water pressure was increased in increments as shown in Table 2 with strain readings taken at each increment. The pressure was then lowered in the same increments with strain readings being taken, and then increased again to the yield point. Sufficient water was induced to produce a 0.2% volumetric offset which by definition is the yield point. The yield point on this joint was found to be 1,500 psi.

TABLE 2—STRAIN-GAGE DATA POINTS

Reading No.:	Pressure	Minimum yield, %
1	0	0
2	344	30
3	459	40
4	574	50
5	826	72
6	1,034	90
7	1,148	100

Test on Joint No. 2

This joint contained three corrosion defects on it as described in Table 3.

TABLE 3—REPAIRS ON JOINT NO. 2

Repair No.	Description of repair
1	Pit was rectangular 2 29/32 in. by 4 14/32 in. by 0.125 in. deep, on outside wall, welded and ground flush.
2	Pit was circular 12/32-in. diameter by 0.005 in. deep, on outside wall, welded and ground flush.
3	Pit was elliptical 1 in. by 28/32 in. by 0.325 in. deep, on outside wall, welded and ground flush. (This was a pin-hole leak.)

The procedure for this test was the same as that on test joint No. 1. Defect No. 3 was complete penetration of the wall; in order to coincide with field conditions on lines in service, the repair was made by welding from the outside only. The yield point of this test joint was found to be 1,545 psi.

TABLE 4—DEFECTS OF JOINT NO. 3

Defect No.	Description
1	Elliptical pit 1 24/32 in. by 29/32 in. by 0.100 in. deep on outside wall.
2	Elliptical pit 2 4/32 in. by 1 in. by 0.175 in. deep, on outside wall.
3	Circular pit 12/32-in. diameter by 0.063 in. deep, outside wall.
4	Elliptical pit 1 16/32 in. by 1 8/32 in. by 0.157 in. deep, outside wall.
5	Elliptical pit 10/32 in. by 24/32 in. by 0.038 in. deep, outside wall.
6	Circular pit 1 12/32-in. diameter by 0.160 in. deep, outside wall.
7	Circular pit 28/32 in. by 0.206 in. deep, outside wall.
8	Elliptical pit 12/32 in. by 24/32 in. by 0.100 in. deep, outside wall.
9	Elliptical pit 2 28/32 in. by 12/32 in. by 0.102 in. deep, outside wall.
10.	Circular pit 24/32-in. diameter by 0.037 in. deep, outside wall.

Test on Joint No. 3

This joint contained 10 corrosion defects on it as described in Table 4.

This joint was tested without making any repairs to the defective areas. This was done for two reasons. First, to see if there was any correlation to the repaired sections since the defects were all of the same type, and secondly, to see if the theoretical yield point was reduced by these defects. A hydrostatic test was applied with the pressure being raised until the pipe yielded. The yield point on this joint was found to be 1,350 psi.

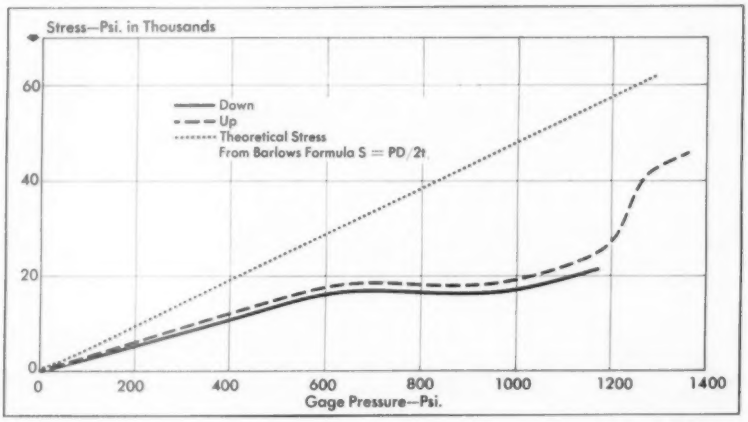
What Tests Revealed

The tests indicated two interesting points: The theoretical yield point of the pipe was not reduced by the welded repairs to these sizes of defects, and the yield point was not reduced by the defect itself without any repairs.

The results of the strain-gage data showed that the stresses of the repaired areas follow very closely the stress taken on a portion of sound pipe where no repair was made. Gages 1 and 3 on test joint No. 2 show stresses above the theoretical stress. These two areas are the ones with large area and complete penetration. More welding would naturally be required to complete a repair. The indications are that this increased stress is welding stresses.

However, sufficient information is not available to evaluate the true level of welding stress. The combination of welding stress with stress due to internal pressure may reach a point where local yielding will take place. It is important that the repair be made to eliminate any notch and be ductile enough to allow this local yielding without initiating a failure.

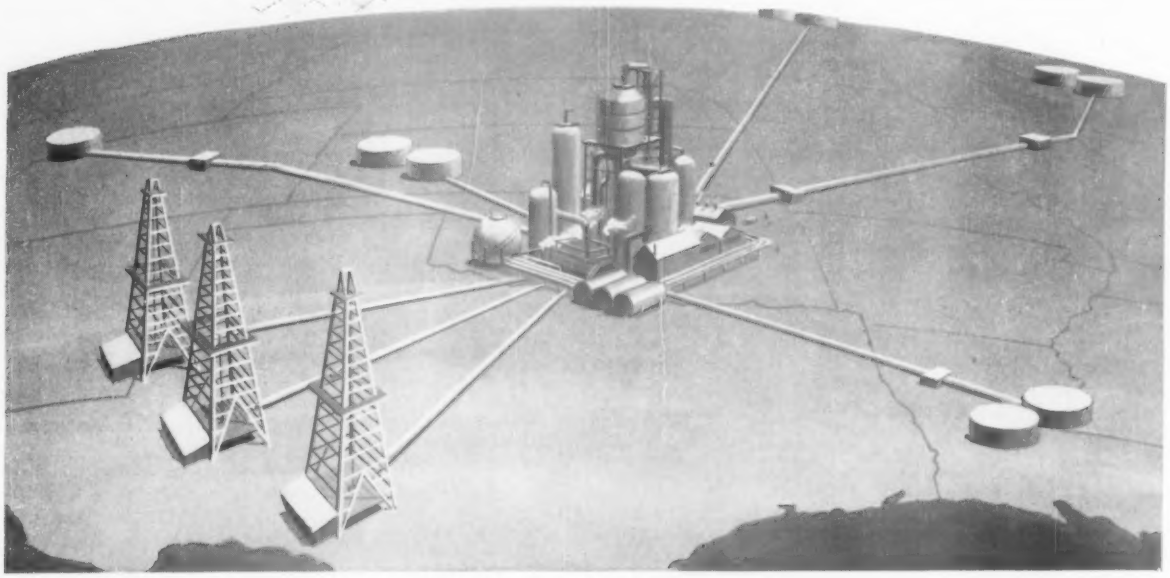
With the exception of repair No. 2 on test joint No. 2, the repairs were made on defects beyond the allowable as specified by the manufacturing specifications, yet they all performed satisfactorily under the testing as required by these specifications. Test joint No. 3 without any repairs also performed satisfactorily and further study should be made to arrive at a scale to show what size defect both in over-all area and depth actually does decrease the yield strength of the pipe. Further investigation should be designed to determine more in detail what effect repeated cycles of stressing without exceeding the theoretical minimum yield would have on welded repaired areas.



PIPE 1, GAGE 3 data from testing repair of elliptical pit 1 20/32 by 1 12/32 by 0.305 in. deep; wall before repair, 0.026 in.; after repair, 0.331 in.

Link Industrial Control Systems Engineering...

SIMULATING PRODUCTS PIPELINES WITH LINK Dialog*



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DIALOG* (Link **Dig**ital-**Analog** System Components and Building Blocks)

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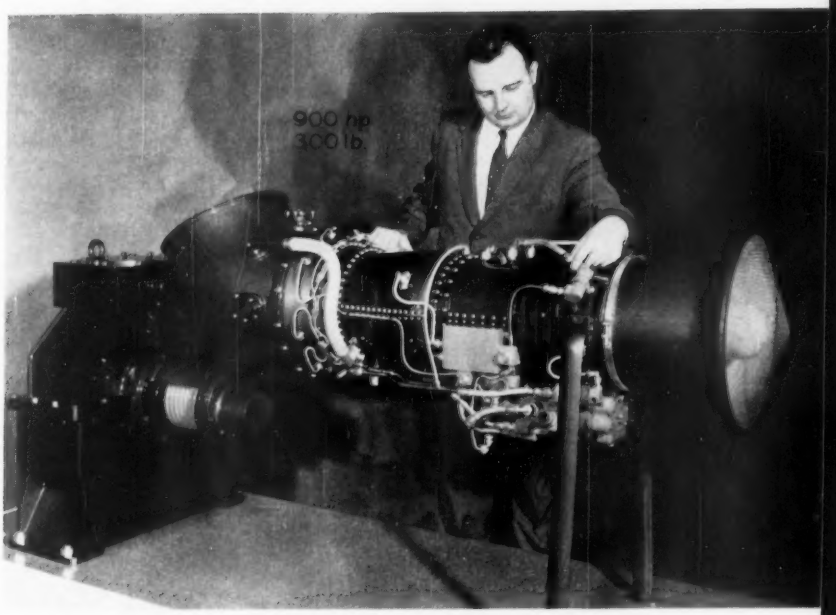
This week's SHOWCASE features . . .

Newest gas turbine is lightweight



NEW GAS TURBINE weighs only 300 lb., but yields 900 hp.

A NEW gas turbine has a high power-to-weight ratio, and the compact size of aircraft jet engines. The gas turbine is designed for use where such factors as mobility and small size are required. Turbine ratings will range from 50 to 20,000 shaft hp. Two models are presently offered. Model 240 is rated at 20,000 shaft hp. Model 720/722 is rated at 900 shaft hp. output.

Model 720/722 will be field tested this year as a drive for an oil-well fracturing unit and as a gas-compressor drive in a main-line pumping station. This model (shown) weighs 300 lb. in its basic form, while typical engine packages with reduction gearing weighs about 1,200 lb. Model 720 operates on such liquid fuels as kerosine, aviation fuel, and diesel fuel. Model 722 operates on natural gas. Thermal efficiency is about 22%. Other specifications include: over-all length with gearing, 85 in.; pressure ratio, 8.3:1, power turbine speed and output shaft speed, 19,500 r.p.m.; reduction-gear output-shaft speed, 2,800 r.p.m.

During the operating cycle of the Model 720/722, air enters a screened bell-mouth inlet, is compressed in a 10-stage compressor, pumped into an annular combustor, mixed with fuel, and ignited. The resulting expanding gases flow through a two-stage gas-generator turbine which drives the compressor, then pass through a single-stage free power turbine whose shaft is the power output source to the reduction gear (shown to the left in illustration).

Fuel consumption for the Model 720/722 is about 11 M. B.t.u. per hp.-hour. Source: **General Electric Co., Schenectady 5, N. Y.**

Processing equipment

. . . can be cleaned with a newly developed cleaner now available that is designed to remove compounded carbon and asphalt soils. Designated Composition 79, it combines solvent emulsion and alkaline properties. The manufacturer recommends it for use by circulation through closed systems in the range of 12 to 16 oz. per gallon of water at temperatures up to 210° F. Its pH in use is 13.5 to 14.0, at the top of the alkaline scale.

According to the maker, it is safe on steel and brass, but its high alkalinity precludes its use where other metals are involved. The compound may also be used in well-ventilated open tanks at temperatures up to 150°

Want more facts about equipment or copies of product literature described in this issue?

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Described in OIL AND GAS JOURNAL - Issue of **April 4, 1960**

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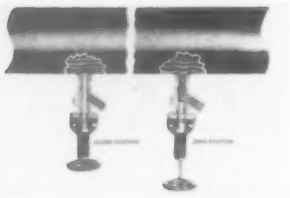
F. The maker reports that, in field tests, the compound has proved effective in cleaning heavily soiled heat exchangers, bubble caps and trays, and stripper towers. Delivery: 1 day. Approximate price, f.o.b. factory: from $140 to $156.75 for large drum, 500 lb. net. Source: **Oakite Products, Inc., 159 Rector Street, New York 6.**

●

Sampling valve

. . . doesn't clog, claims the maker of this No. SV-700 valve. The nonclogging is achieved by a stainless-steel piston which, in the closed position,



completely fills the valve body and extends to the inner surface of the vessel. When the piston is retracted, it leaves the entire body free for a full flowing sample. Two compressible, replaceable Teflon rings seal the valve.

The sampling valve is designed for simple installation in existing systems. Merely weld a ¾-in. half coupling into the pipe or vessel from which samples are needed. The valve comes with pipe threads, ¾-in. male inlet and ½-in. female discharge. Delivery: 4-6 weeks. Approximate price, f.o.b. factory: $65. Source: **Straham Valves, Inc., Florham Park, N. J.**

●

Turn a gage

. . . in any direction with a new leakproof revolving gage connection that has been developed for pressure gages, according to the maker. With a pressure gage threaded into the assembly, the connection rotates at the top to allow the gage to be turned to face any direction for easier reading.

The revolving connection is designed for use with conventional pressure-gage connections. Where space is limited, the device promises to provide flexibility and to save space. Details are given in Brochure 15-01. Delivery: 1 week. Approximate price, f.o.b. factory: from $19.75 down to $11.55 for quantities of 100 or more. Source: **Macco Oil Tool Co., Inc., Box 7288, Houston 8.**

●

Air-powered chisel

. . . produced that can be valuable to shear metal, cut metal, cut rivets, drive rivets, scrape metal, break welds, punch sheet-metal holes, split nuts, shear bolts, pull pins, drive bearing races and pressed bearings, and crimp sheet metal.

The tool, designated the Sioux Slugger, has a one-piece barrel without parts to become misaligned or wear and a cast-iron handle to take rough use. The manufacturer claims that use of the tool does not create a fire or explosion hazard. List price of the tool: $85. Source: **Albertson & Co., Inc., Sioux City, Iowa.**

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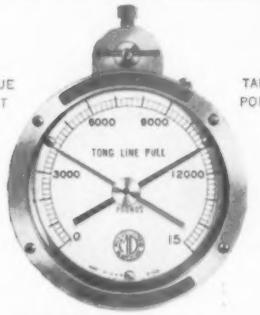
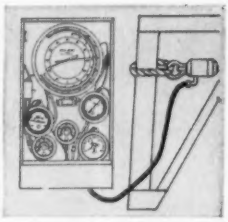
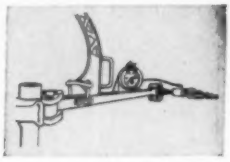




PERMANENT INSTALLATION
The cylinder attached to the back-up line provides torque indication each time collars are run.



PORTABLE INSTALLATION
The torque assembly attached to the tong itself can be used for spot checks on two or more rigs.

ONE GAUGE for torque measurements of all size drill collars, drill pipe, tubing and casing.

ACCURATE AND RELIABLE readings with calibration checks seldom required.

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Colmonoy Hard-Surfacing
Protects Plungers
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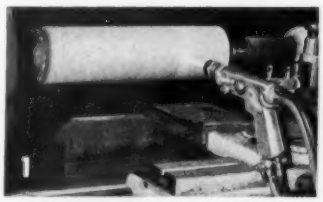
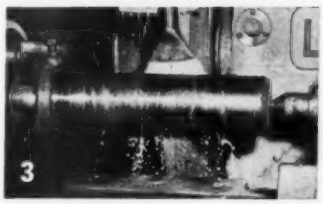
Applying Colmonoy Sprayweld Hard-Surfacing:*



1
Plunger is prepared for spraying by undercutting and grit blasting. The Colmonoy Spraywelder sprays powdered Colmonoy alloy on the turning part.

2
The Colmonoy surface is then heated to about 1900° F. to create a welded bond between overlay and base metal.



3
Sprayweld overlays are smooth and evenly applied, require little finish grinding.

Ask for the Spraywelder Catalog and Colmonoy Hard-Surfacing Manual No. 79.

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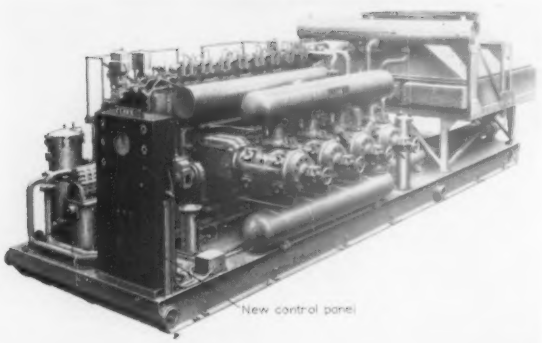

New control panel

Simpler compressor operation

. . . is promised by a new series of automatic-control panels now on the market for HMB-TMB packaged field compressors. They consist of a complete pneumatic starting and stopping system which operates on 75-psi. air or gas pressure. The control is furnished as an integral part of the compressor package. Each panel is engineered to match the operating characteristics of the compressor. It is tested with the unit to assure reliable performance before delivery.

The control panels can also be installed on the maker's compressors now operating in the field. An advantage of the control panels is that they can eliminate the variables of human judgment and enable an operator to start or stop an engine with the push of a button. All functions are sequenced in a predetermined automatic cycle. If you wish, yard valves and compressor cylinder unloaders can be tied into the panel for manual or automatic operation. The panel can be tied into a remote starting system. Source: **Clark Bros. Co., Div. of Dresser Industries, Inc., Olean, N. Y.**

Tight shutoff

. . . for corrosives either gas or liquids as well as slurries is provided by a valve now being produced with Viton-faced plugs. The resilient Viton facing in combination with the eccentric action of the valve provides a dead-tight shutoff, the maker claims.

Properties of Viton that make it suited for use as a plug-facing material, according to the maker, are: (1) no cold flow, (2) highly resilient, and (3) undamaged by slurry particles. The temperature limits of Viton are reportedly higher than those of most rubber compounds; on some services it can be used at temperatures up to 350° F. Source: **DeZurik Corp., Sartell, Minn.**

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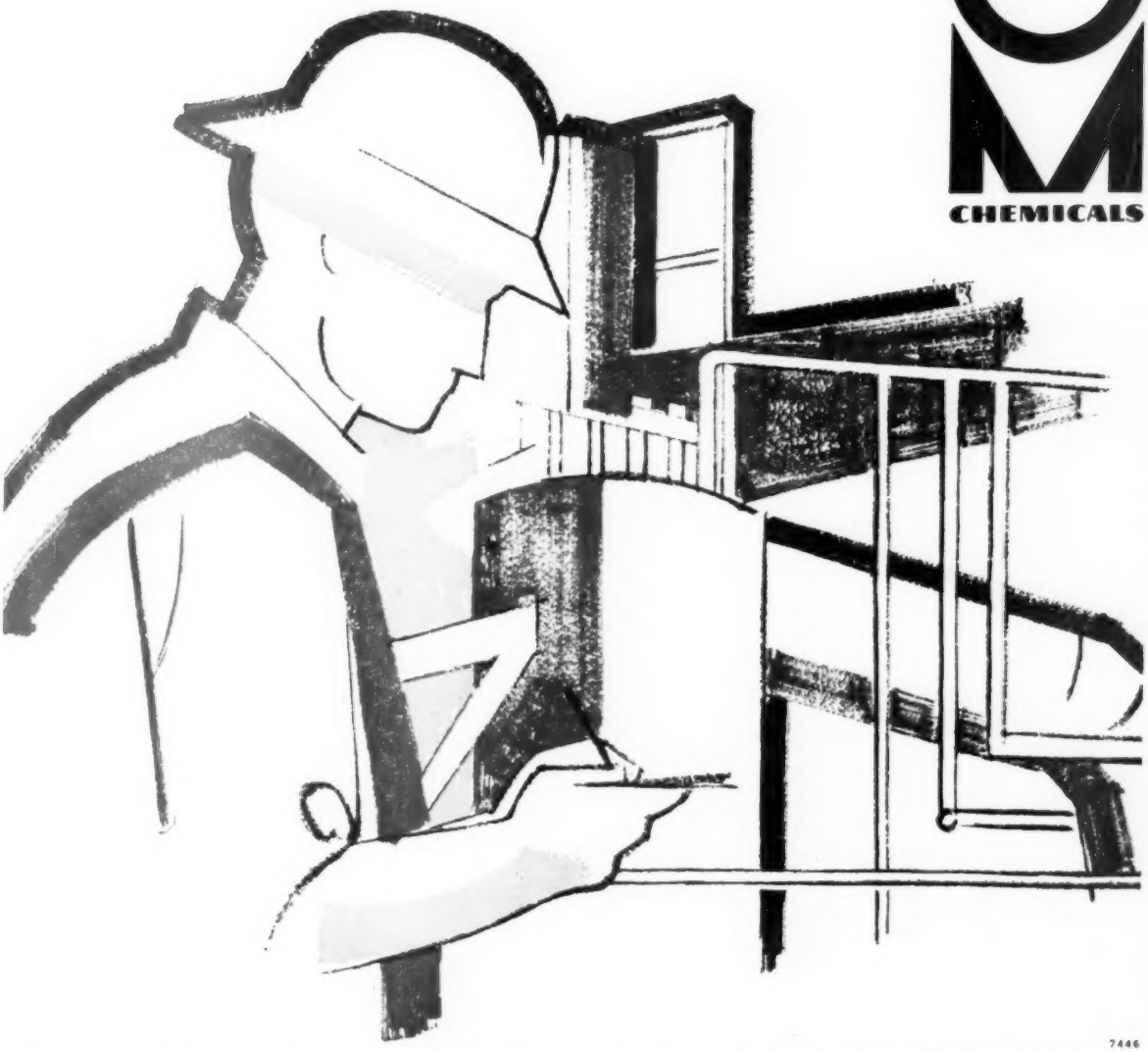

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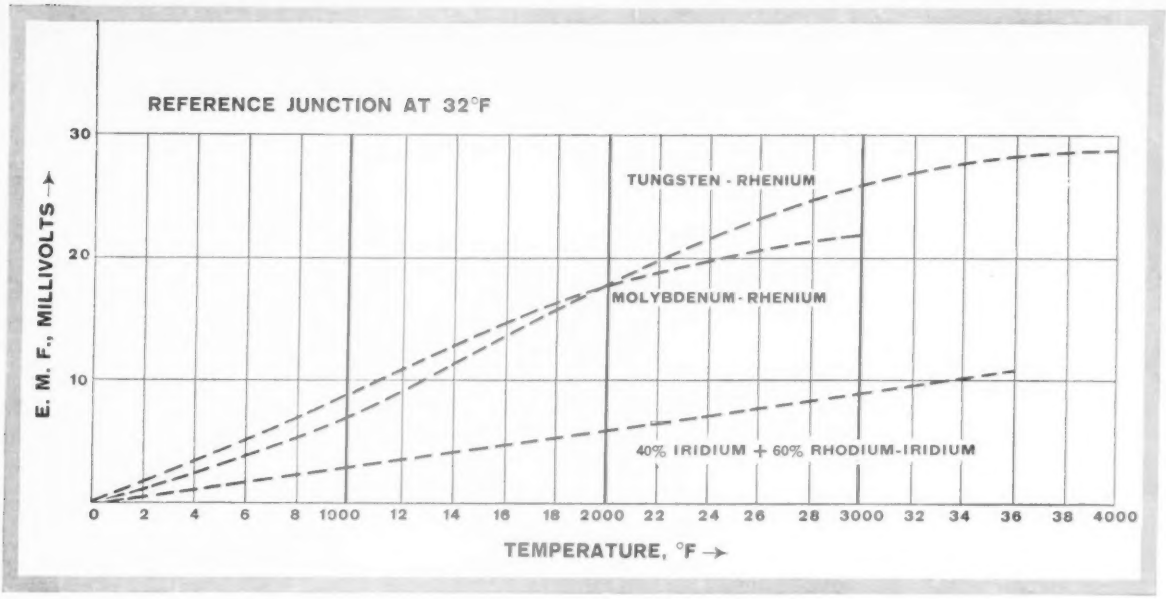
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20
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TUNGSTEN - RHENIUM
MOLYBDENUM - RHENIUM
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Honeywell

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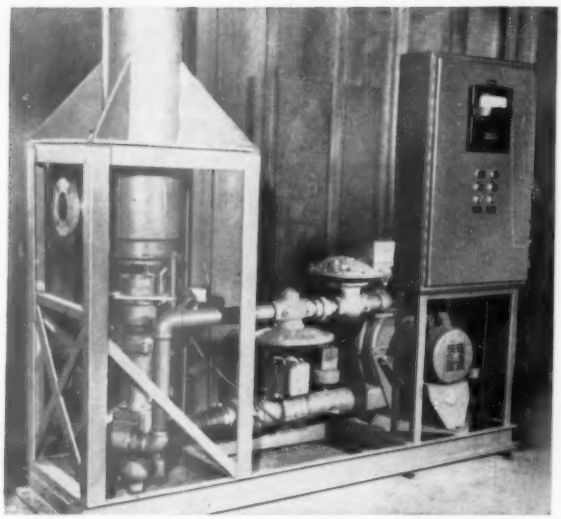
*HIGH TEMPERATURE ASSEMBLIES WITH PROTECTING TUBE**

Calibration	Maximum Recommended Temperature	Tube & Insulator Material	Tube Dimensions I.D. (in.)	Tube Dimensions O.D. (in.)
TUNGSTEN-RHENIUM	3200°F	ALUMINUM OXIDE	3/16	5/16
	4000°F	BERYLLIUM OXIDE	1/4	3/8
MOLYBDENUM-RHENIUM	3000°F	ALUMINUM OXIDE	3/16	5/16
40% IRIDIUM+ 60% RHODIUM-IRIDIUM	3200°F	ALUMINUM OXIDE	3/16	5/16
	3600°F	BERYLLIUM OXIDE	1/4	3/8

*HIGH TEMPERATURE ASSEMBLIES WITHOUT PROTECTING TUBE**

Calibration	Maximum Recommended Temperature	Insulator Material	Insulator Dimensions I.D. (in.)	Insulator Dimensions O.D. (in.)
TUNGSTEN-RHENIUM	3200°F	ALUMINUM OXIDE	0.028	0.140
	4000°F	BERYLLIUM OXIDE	0.028	0.130
MOLYBDENUM-RHENIUM	3000°F	ALUMINUM OXIDE	0.028	0.140
40% IRIDIUM+ 60% RHODIUM-IRIDIUM	3200°F	ALUMINUM OXIDE	0.028	0.140
	3600°F	BERYLLIUM OXIDE	0.028	0.130

*Most assemblies available in 5", 11" 17", 20", 23" and 29" immersion lengths



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. . . now. The Type 102 fired heaters have been used for some time for heating gases, vapors, and liquids at temperatures up to 1,000° F. in capacities from 100 M. B.t.u. per hour in a 2½-in. IPS tube up to 1 M.M. B.t.u. per hour in a 10-in. IPS tube. The heaters are now being made available prepackaged from the factory to reduce the installation time and cost of installing fired heaters in the field

All combustion, flame-safety, and automatic-control equipment is mounted in position, wired, and ready for operation. This feature can permit faster and easier installation and eliminate engineering. Installation only requires that the heater be mounted on the combustion section and two connections made for the fuel and electricity.

In packaged form, the heater can also eliminate costly parts assembly, as no time is lost on the job in laying out, purchasing, and hooking up pipe fittings, valves, wiring, and controls. Normal delivery: 8-10 weeks. Approximate list price, f.o.b. factory: for a small carbon-steel, 100-M. B.t.u. per hour heater, $1,500, including all combustion equipment and controls. The control panel and prepackaged combustion section adds about $600, making about $2,100 total. For a larger unit with a 1M.M. B.t.u. per hour capacity, the price for the heater, including combustion equipment, flame safety equipment, and automatic controls, is about $3,300. The complete prepackaged combustion section adds about $750, making a total of about $4,050. Source: **Brown Fintube Co., 300 Huron Street, Elyria, Ohio.**

•

Two-way radio

. . . to be available operates in the band from 25 to 54 mc. An addition to the maker's Motrac line, the low-band, 100-watt radio will accommo-

CROSE

NEW ROAD BORING MACHINE

CENTER SEAT FOR OPERATOR — Sitting in seat located directly over center of machine, operator can keep casing lined up perfectly with hole being bored.

REVERSE-O-MATIC TRANSMISSION — With this new type transmission, operator can switch auger from forward to reverse without engine slowdown. No gear shifting.

HEAVY DUTY TORQUE CONVERTER — For full, constant speed and smooth power flow, eliminating up to 90% of shock load imposed on drive train.

The new Crose Road Boring Machine provides the fastest, simplest, most economical way for boring crossings and installing casings up to and including 42" in diameter. Heavy duty torque converter and reverse-o-matic transmission deliver full, constant speed and smooth power flow . . . let you switch auger from forward to reverse without engine slowdown . . . no gear shifting.

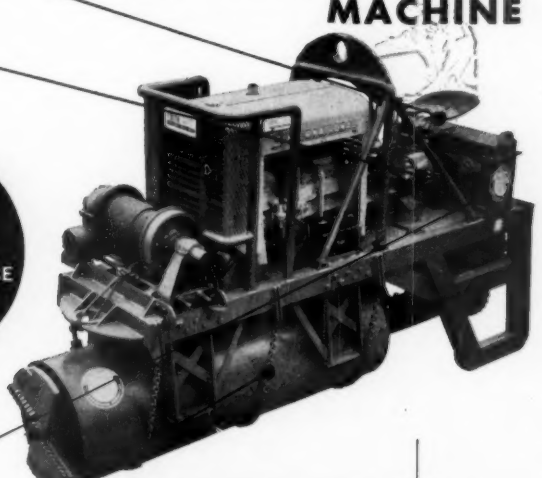
The smaller Model RBA Crose Road Boring Machine is still available for casing up to 24".

WRITE CROSE TODAY FOR COMPLETE INFORMATION

NEW GEAR AND CHAIN BOX — With pressure lubrication feature — has been added to the new Crose Road Boring Machine for greater power capacity.

CASING CLAMP BANDS ELIMINATED — Instead, you use adjustable casing chains which can be easily installed or removed when machine is in ditch.

FIELD-TESTED TOP PERFORMANCE



Crose perrault EQUIPMENT CORP.

2765 Dawson Road • Phone WEbster 6-2171 • Tulsa, Oklahoma •
BRANCH OFFICES: Houston, Texas • Elizabeth, N. J. • IN CANADA:
Edmonton, Alberta • Toronto, Ontario • EXPORT OFFICE: New York, N. Y.

. . . one of a series presented by Western Supply Company, Tulsa, to improve the "I.Q."* of engineers . . .
(*"Income Quotient")

Personal, professional advancement demands thorough engineering knowledge, disciplined habits, creative thinking, constant application

"Intellectual let-down" — that tendency so common to many engineers to "stop learning" as soon as they acquire a sheepskin — will be completely out of style by 1999. Indeed, it is passe in today's accelerated engineering profession, because to stop learning is to stop growing: to stifle imagination, to throttle creativity, and ultimately to kill scientific progress.

The engineer who would keep pace with his own industry — especially the process industry — must determine to follow a prescribed, disciplined course of action, if he is to achieve the stature, prestige, responsibility and income to which he aspires. He must recognize that only as his engineering achievement advances will his personal well-being also increase.

There is no magic formula for the "successful engineer," but for what they are worth to your professional future, here are 14 "ground rules" for your consideration:

Set objectives for your professional and personal life, re-examine them periodically, but always work towards a goal in life.

Develop sound work habits. Earn a reputation for promptness, attention to detail, accuracy, diligence, reliability.

Continue to study your chosen field or specialty. Your learning process must never cease functioning.

Seek additional training, technically or in non-technical fields which can be of importance to future development.

Think creatively about your job, your company, technological advances and developments. Dare to think **beyond** your capacity.

Expand your capacity to discover new fields of endeavor, discriminatingly, however, so that they will have application to your objectives.

Take a genuine interest in people, their potentials, their problems. Understand, but don't condemn, their shortcomings.

Broaden your base of appreciation for other pursuits, such as sales, accounting, law, advertising. They, too, are important to your company.

Study the fundamentals of business. Learn the economics of your company, its basic philosophy, its obligations and responsibilities, its opportunities and limitations.

Seek advice and counsel from others; don't rely entirely on your own resources . . . Ask questions.

Participate actively in technical societies; keep alert to professional trends, changing concepts, new developments.

Use common sense and sound, practical judgment in evaluating everything from people to processes.

Aggressively pursue your professional and personal ambitions, but with patience and intelligence.

Learn to communicate your ideas and opinions pleasantly, clearly, concisely, aggressively to your superiors, associates, subordinates.

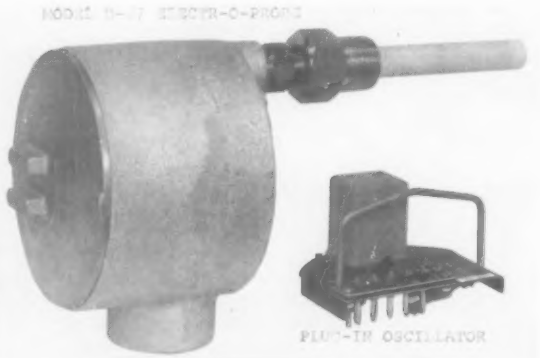
The development of a successful career in engineering bespeaks **constant, consistent dedication** to professional and personal principles. Perhaps these few paragraphs can serve as a guide for your own engineering future and advancement. (Footnote: for more detailed discussion of the suggestions made herein, write for your free copy of "14 Ground Rules," to WESTERN SUPPLY COMPANY, HEAT EXCHANGER DIVISION, P. O. BOX 1888, TULSA, OKLA. — and if there's a heat exchanger in your company's future, we'd like to demonstrate how these "14 ground rules" affect our heat exchangers!

SHOWCASE . . .

New Equipment

date either positive or negative vehicle-battery-ground polarity. The maker claims it provides low operating costs and the highest reliability. Transistors are used in all receiver and power-supply circuits and in two transmitter circuits.

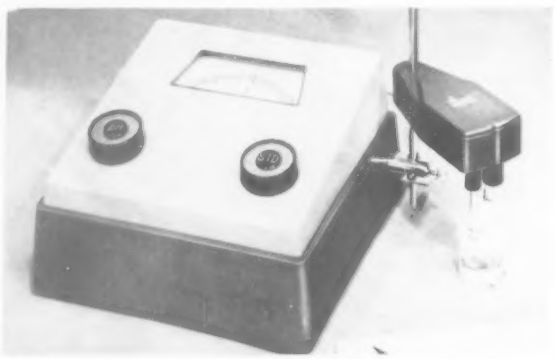
Reportedly, the 100-watt unit will draw no more than 0.5 amp. plus intermittent crystal heater drain while on standby. Delivery: 18-20 weeks. Approximate price, f.o.b. factory: from $890 for standard squelch, one-frequency transmitter, receiver to $1,060 for dual-squelch, two-frequency transmitter, receiver. Source: **Motorola, Inc., 4501 West Augusta Boulevard, Chicago 51.**



Level control needs little space

. . . as it is transistorized for compactness and has been thoroughly field tested to prove its suitability for high and low-level detection of liquids, granular solids, and liquid-liquid interfaces, the maker reports. The solid-state circuit design eliminates the use of vacuum tubes and, the maker claims, results in greater sensitivity and stability.

Features to note on the Model B-07 Electro-O-Probe level control include unitized, explosionproof construction, choice of fail safe or direct action, and models available for operation on 115-volt 60 c.p.s. a.c. (maker's standard unit) and on 12 or 24-volt d.c. Delivery: 2-3 weeks. Approximate price, f.o.b. factory: from $136 for 12-volt and 24-volt units to $151 for 110-volt a.c. unit. Source: **Instruments, Inc., Box 556, Tulsa.**



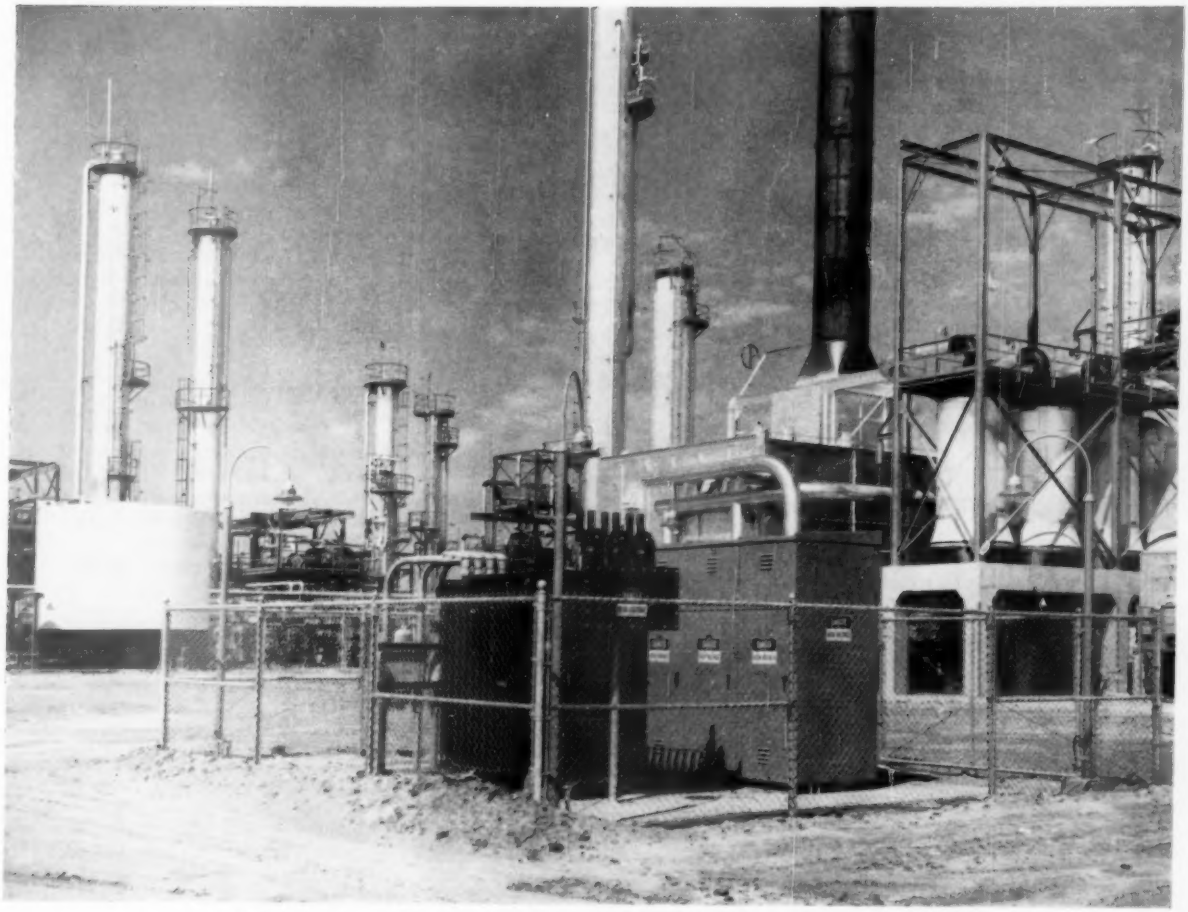
Newest design in pH meters

. . . is this Metrion meter. Features include an extended range using large, clear duplex scales covering 0 to 10 pH and 4 to 14 pH. It accepts all modern pH electrodes.

The instrument is housed in a compact case with high resistance to shock, acids, and stains. Details are given in Bulletin B-257. The instrument is priced at $139. Source: **Coleman Instruments, 42 Madison Street, Maywood, Ill.**

You can depend on purchased electric power for

LOW MAINTENANCE



Substation for purchased electric power supplying a large southern refinery.

For energy that reduces operating costs, many refineries rely on purchased electric power.

The refinery shown here is only one of hundreds of installations throughout the country where utility electric power is at work around the clock . . . with a record of high continuity of service and low upkeep.

Whether your operation involves refineries, pipelines, gathering, flooding or pumping check with your nearest Utility Electric Power Company for assistance in economical electrification.

Purchased Electric Power . . .
saves money, manpower, maintenance, and serves you better automatically

Petroleum Electric Power Association

P. O. BOX 35006, DALLAS 35, TEXAS

SHOWCASE . . .

New Literature

Diesel-engine

. . . maintenance booklet entitled Ten Maintenance Steps tells how to increase equipment availability, reduce operating costs, and obtain better engine performance. The 24-page literature deals with the following topics: (1) keep dirt out of the engine; (2) maintain a lubricating film on all bearing surfaces; (3) regulate the engine's fuel; (4) control operating temperatures; (5) guard against corrosion; (6) let the engine breathe; (7) prevent overspeeding; (8) know your engine's condition; (9) correct troubles while they are simple; and (10) schedule and control your maintenance. Source: **Cummins Engine Co., Inc., Columbus, Ind.**

Corrosion-resistance

. . . chart now available lists more than 150 different chemicals and their recommended usage with ductile iron, iron, steel, 316 and 304 stainless steel, monel, brass, bronze, copper, aluminum, and plastisol plastic.

Chart J-CRC also shows which gasket materials are needed for the various chemicals when Kamlock quick couplers are used, and which O-ring materials are needed when swivel joints are used with these chemicals and compounds. Source: **OPW-Jordan, 6013 Wiehe Road, Cincinnati 13.**

Water flooding

. . . and disposal equipment is the topic of a newly published illustrated brochure, yours for the asking. The 8-page brochure presents different types of equipment suitable for various operating conditions. It also offers suggestions for correct equipment selection. Source: **Jones & Laughlin Supply Div., P. O. Drawer 2481, Tulsa 2.**

Ball-valve

. . . brochure entitled "At Your Service" is a pictorial synthesis of all double-ball Jamesbury valves, depicting the series of product data sheets available to all who desire further detailed information on any given valve type or accessory item. A similar brochure, bearing the same title, proved to be so popular in the past that this newly revised and updated piece was prepared. Source: **Jamesbury Corp., Worchester, Mass.**

Pulsafeeder

. . . metering pumps in process industries are discussed in new 28-page Catalog 59, obtainable gratis upon request. The pumps are designed to solve pumping problems where hard-to-handle chemicals or accurate metering is involved.

The catalog includes the following information: how the Pulsafeeder can be used; types of hard-to-pump fluids which the pump can handle; a detailed description (with drawings) on how the Pulsafeeder works; and various types of reagent heads available for metering difficult fluids.

Special sections are devoted to autopneumatic and electronic controls, as well as descriptions and illustrations of metering pumps available for all types of process service. Included are two pages of tables showing capacities, sizes, and specifications. Source: **Process Equipment Div., Lapp Insulator Co., Inc., 112 Hall Street, LeRoy, N. Y.**

Socket-weld fittings

. . . in ⅛ to 1-in. o.d. tube sizes are outlined in new 4-page Bulletin SW358, yours free for the asking. It

COOLING TOWER INSTALLATION

In the typical cooling tower installation shown above, the motor — outside the humid or corrosive atmosphere — is connected by a floating-shaft coupling to the gear box under the large slow-speed, horizontal-blade fan.

REFINERS! PIPE LINE MEN! DRILLING ENGINEERS! LABORATORY TECHNICIANS!

Thomas Couplings are used to advantage on Pumps, Compressors, Cooling Towers, Rigs or any other tough job where continuous operation and dependability are required.

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings.

Under Load and Misalignment only Thomas Flexible Couplings offer all these advantages:

1 Freedom from Backlash Torsional Rigidity
2 Free End Float
3 Smooth Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

THOMAS

THOMAS FLEXIBLE COUPLING COMPANY
WARREN, PENNSYLVANIA, U.S.A.

gives applications, installation data, materials, and dimensional tables. Another data sheet highlights a new floating seat said to give double protection against line losses.

It includes a cutaway view with illustrations, along with tube-fitting dimensions. A third literature piece (Bulletin KU-759) features stainless-steel pipe unions with Teflon seal. This 4-page publication offers informative text, advantages, photos, and specifications tables. Source: **Special Screw Products Co., Bedford, Ohio.**

Screw-conveyor

. . . screw feeders, and component uses and selection are detailed in a new brochure just released. The 76-page publication illustrates over 20 different types of screws, 14 types of troughs with 4 cover types, 5 types of discharge openings, and 2 types of feeders.

Brochure 2989 shows how screw conveyors are used for conveying and elevating, distributing, reclaiming, collecting, mixing, blending, agitating, aerating, heating, and cooling materials. It also contains an extensive list of materials for which the conveyors may be used. Source: **Link-Belt Co., Prudential Plaza, Chicago 1.**

Ketones are described

. . . as solvents and chemical intermediates in a new 48-page booklet just published. It offers data on 15 ketones and diketones, including information on applications, coatings, formulations, physical properties, solvent properties, constant-boiling mixtures, shipping, storage, handling, physiological properties, specification limits, and test methods. Featured is a comprehensive bibliography on ketones and their uses. Source: **Union Carbide Chemicals Co., 30 East Forty-Second Street, New York 17.**

Corrosion inhibitors

. . . for refiners are outlined in a new, obtainable 8-page brochure, yours for the asking. Supplemented with schematic diagrams, detailed engineering drawings, and photographs, the literature explains and evaluates the application of Kontol corrosion inhibitors to various refinery systems.

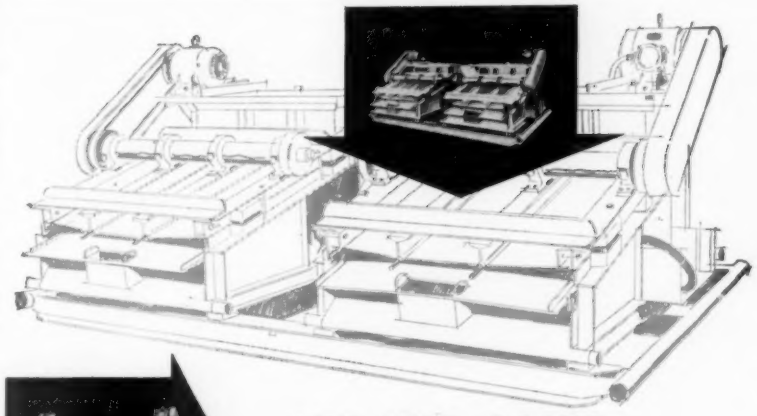
The brochure describes how and why Kontol is effective in correcting such problems as hydrogen blistering, and in supplementing pH control. Source: **Tretolite Co., Div. of Petrolite Corp., 369 Marshall Avenue, St. Louis 19.**

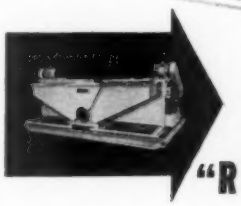
Toggle switches

. . . and assemblies Catalog 73d presents a wide selection of applications that have been tested and approved under MIL-S-3950A, as well as pull-to-unlock, hermetically sealed, "electrical memory," rocker-actuated, and miniaturizer designs. The catalog offers 32 pages packed with detailed descriptions, photographs, diagrams, dimensional drawings, and specification tables. Source: **Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.**

NEMA standards

. . . for definitions, terminology, and performance - measuring instruments pertaining to solid adsorbent-type air and gas dehumidifying and dehydrating equipment are contained in a free publication just announced. These standards are accepted and adhered to by a large percentage of the American manufacturers of this type of equipment. They are the first standards so accepted and used. Source: **Gas Drying, Inc., P. O. Box 56, Summit, N. J.**





CUT MUD COSTS TWO-WAYS WITH "RUMBA" SHALE SHAKERS

"RUMBA" Shale Shakers with De-Sanders will cut your drilling mud costs by removing more shale and sand to give you a cleaner mud, while saving you money on your shaker investment.

"RUMBA" handles more mud, more efficiently because the mud is evenly channeled from the spreader box and directed over the *full width* of the screened surface area. To insure maximum removal of cuttings, "RUMBA" Shakers are equipped with five foot lateral frame struts and distribute an equal amount of vibration to every inch of the under-slung, stainless steel screen cloth. The under-slung vibrating screen cloth also removes tons of sand that would otherwise damage pumps, pistons, liners, and valves. The cloth is attached with stainless steel hooks that will not rust or corrode. Hooks last the life of the screen.

"RUMBA'S" new and improved design of mud tank, by-pass and return mud outlet has been enlarged to handle the flow of the largest pumps in the industry. "RUMBA" Shale Shakers are built stronger. Require less maintenance than any other type of shale shaker.

"RUMBA" Shale Shakers and De-Sanders are sold through supply stores everywhere.

HUTCHISON MANUFACTURING COMPANY
P. O. BOX 9335 • HOUSTON 11, TEXAS

A SUBSIDIARY OF REVERE ELECTRIC MANUFACTURING CO.

TOUGH WINTER JOB WITH CATERPILLAR'S NEW

New Cat No. 583 Series H Pipelayer cradles for the dope and wrap machine. It is one of 14 Caterpillar-built rigs used on this spread by Engineers Limited Pipeline Co., El Cerrito, California.

New Cat No. 572 Series D Pipelayers handle 26-in. pipe. Production on the 138-mile project averaged 8000 to 9000 feet a day.

---EASIER EQUIPMENT

New Cat D9 Series E Tractor with Kelley Ripper manufactured by Crutcher • Rolfs • Cummings, Inc., rips through frozen ground. The D9 also handled clearing and backfilling jobs.

You expect problems on any pipeline job. And this one, from Rossville, Illinois, to White Pigeon, Michigan, is no exception. Engineers Limited Pipeline Co. has the contract for laying 26-in. pipe on this 138-mile stretch for the Trunkline Gas Co. of Houston, Texas. To push the job through, Engineers Limited set up an equipment spread on each end of the line—*100% Cat.*

The job started in December under severe winter working conditions. Frozen ground presented a digging problem. When it thawed, there was a drainage problem in areas with high water levels. Cat equipment on the western spread included a giant new D9 Series E Tractor with Kelley Ripper ripping the frozen ground in one pass . . . a new No. 583 Series H Pipelayer alternating between lowering and wrapping duties . . . five new No. 572 Series D Pipelayers with cradling and lowering-in assignments . . . and D8 and D7 Tractors.

Have you seen the new pipelayers?

New model or old-timer, Cat pipeline rigs get tough jobs done in a hurry. But to know what *performance* really means, look at the three new Cat-built Pipelayers—they incorporate advances in design and manufacture that increase your production and lower your operating and maintenance costs. They are briefly described here, but for complete information, see your Caterpillar Dealer. Learn about the giant strides in progress made in the three newest Cat pipeline rigs.

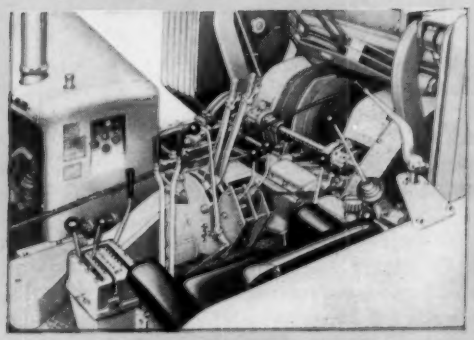
Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

MODERN, HEAVY-DUTY PIPELAYERS FOR THE HARD WORK

3 NEW CAT-BUILT PIPELAYERS

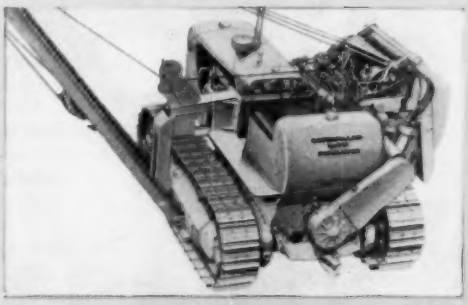


No. 583 Series H
235 HP 137,000-lb. lift

Now optional on the No. 583—Power Shift Transmission! Big boon to any operator, it gives the No. 583 new finger-touch control, split-second gear changing . . . new precision control even in the toughest terrain . . . new top efficiency in all speeds and working conditions. The heaviest pipe jobs can now be handled even faster with the No. 583 with Power Shift Transmission! And the closely-retractable counterweights and good machine balance under load make the No. 583 champ of any job.

No. 572 Series D
140 HP 86,000-lb. lift

A new Turbocharged Cat Engine gives the new No. 572 a 9% increase in power over the former model. The most modern pipelayer in its class, it has such advanced Caterpillar features as lifetime lubricated rollers . . . the dry-type air cleaner, which removes 99.8% of all airborne dirt from engine breathing . . . and many others. It's the "take charge" machine for handling 26-in. pipe with capacity left over.



No. 561 Series B
93 HP 38,800-lb. lift

A new power plant that delivers 93 flywheel HP is designed for high torque at slow speeds, long life under heavy loads. The No. 561 is available with hydraulically-controlled counterweights or stationary arrangements for a wide range of lifting capacities. A new cockpit provides more comfort, easier control. Other features are the exclusive Cat oil clutch . . . hydraulic track adjusters that permit track adjustment with the easy stroke of a grease gun . . . and, of course, lifetime lubricated rollers. This new rig can handle more of your jobs with ease, speed and profit!

▶▶▶ Equipment Men Notes

Caterpillar Shifts Engine Sales Personnel

H. H. HOWARD, vice president of the Peoria, Ill. company's engines sales department, reports that Jack H. Gill has been promoted to assist him (Howard) in a staff position with a variety of Engine Division functions. Gill previously was engine sales manager. At the same time, Fred V. Jacobs moves from manager of Caterpillar Tractor Co.'s Sales Development Division to serve as Engine Division sales manager.

To facilitate operations which are essential to Caterpillar's engine sales, the sales department has been divided into three sections. Each is headed by a division manager and all serve under Jacobs.

Bob Cumming, formerly assistant sales manager, takes over as manager of the Manufacturers Sales Division. Hugh Rose, who was the Engine Division's sales coordinator, is now manager of Caterpillar Dealer Sales Division. The third division, Sales Development, is headed by Gene Sterrett. Sterrett moved into the industrial engine plant from Tulsa where he served as a field representative.

Bob Cumming

Hugh Rose

Gene Sterrett

H. H. Howard

J. H. Gill

F. V. Jacobs

New corporation is formed

M. H. Jackson

. . . with general offices located in Tulsa—the M. H. Jackson Pipeline Supply Co. The organization will begin its first operations with sales efforts directed to transmission and producing companies throughout the country, as distributor representatives of several manufacturers of pipeline coating and wrapping materials, tape-wrapping materials, pipe-beveling machines and pipe-handling devices, as well as small-diameter API line pipe.

R. B. Wallace

Woodrow Cole

President and chief executive officer is M. H. Jackson. R. B. Wallace will concentrate efforts on product sales in addition to new product acquisition and production. Woodrow Cole is treasurer and office manager.

The company also announced plans for formation of a manufacturing division later this year which will permit entry into its second operational phase—that of manufacturing and distributing its own line of equipment used by pipeline contractors in laying product-carrying pipelines throughout the world.

Wayne Overman to manage

Wayne Overman

. . . the Shreveport district of Tuboscope Co., announces A. B. Roop, vice president and general manager. Overman, who recently opened Tuboscope's office in Shreveport, will assume responsibility for the company's sales and service for Arkansas and North Louisiana.

Previously Overman was field superintendent for Tuboscope's Harvey, La. district. He has been with the company for 5 years, beginning in the Houston headquarters office.

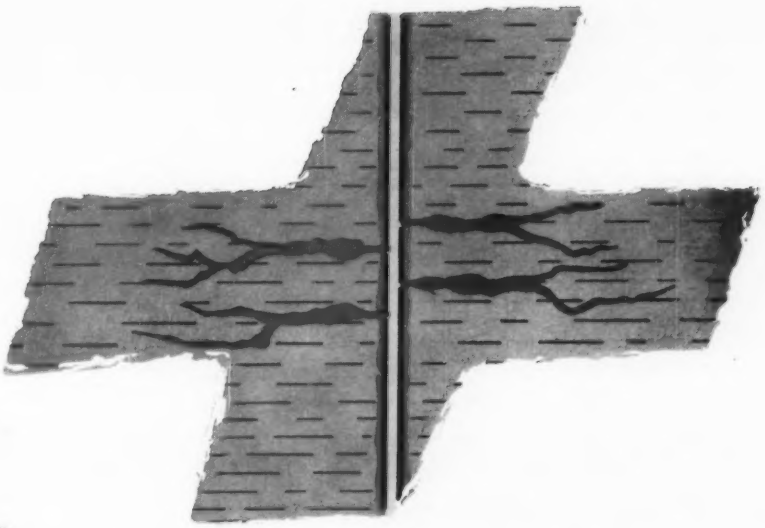
Orbit Valve Co. appoints

. . . Barber Machinery Co., Edmonton, Alta., as authorized factory-repair-service representative in western Canada. J. Mumford, Orbit's vice president of sales, stated that Barber Machinery is fully equipped and staffed for valve-repair service identical to that conducted at his company's Tulsa plant. Orbit's Canadian sales representative is T. R. Pickford & Co., Ltd., in Calgary.

34 transfers, promotions made

. . . by Houston Oil Field Material Co., Inc. These include: C. M. Hart, transferred from Fort Worth to Dallas as city supply salesman; John York, from Victoria to Alice, Tex., as rental field salesman; Jerry L. Williams, named electrical well service rigger at Harvey, La.; C. M. Williams, from electrical well service rigger to warehouseman at Brookhaven, Miss.; Eugene Webb, from division manager of East Louisiana to manager of the Louisiana and Mississippi divisions; M. B. Watson, from Pearsall to Victoria, Tex.; Norman Vogan, from Long Beach to Ventura, Calif.; Gerald B. Stewart, from New Iberia, La. to Oklahoma City as a directional-drilling engineer; and Homer G. Smith, Jr., from junior project engineer to senior project engineer at Houston.

Other changes involve: Guy M. Shipley, from district representative, directional drilling, to district manager at Odessa, Tex.; Robert P. Schmitz, from warehouseman to district supply representative at New Iberia; E. E. Scallorn, from New Iberia to Morgan City, La., as fishing-tool supervisor; Roy W. Satterfield, fishing-tool supervisor at New Iberia; George Rush, from foreign sales and service representative to export sales at Houston; R. R. Robbins, from Lafayette to New Iberia as electrical well service supervisor; George W. Richardson, from warehouseman to field service salesman at Brookhaven, Miss.; Richard R. Rice, rental salesman at



A NEW PLUS ... FOR WATERFRAC

Since its introduction several years ago, Halliburton's Waterfrac ... using gelled water and fracturing sand has gained wide popularity as a highly effective fracturing technique for production stimulation in many areas.

Now, Halliburton Waterfrac has been improved and simplified by the introduction of WG-4 ... a *new* water gelling agent which allows continuous preparation and injection into the well. Some of the money-saving advantages you get with WATERFRAC and WG-4 as opposed to a batched gelling system are:

- No material is wasted due to surplus batching.
- No batching tank is required ... eliminates batching time too!
- Pre-gelling and common pumping problems are avoided.
- Ratios of *this* gelling agent-to-water and the sand-to-water may be *individually* controlled.

This new WATERFRAC *plus* is another example of the leadership Halliburton has pledged to you in the continuing development of more efficient production stimulation techniques to help you increase profits from your wells.

Let the experience of your local Halliburton Representative help on your next fracturing job.

FIRST ... AND STILL FOREMOST ... IN FORMATION FRACTURING

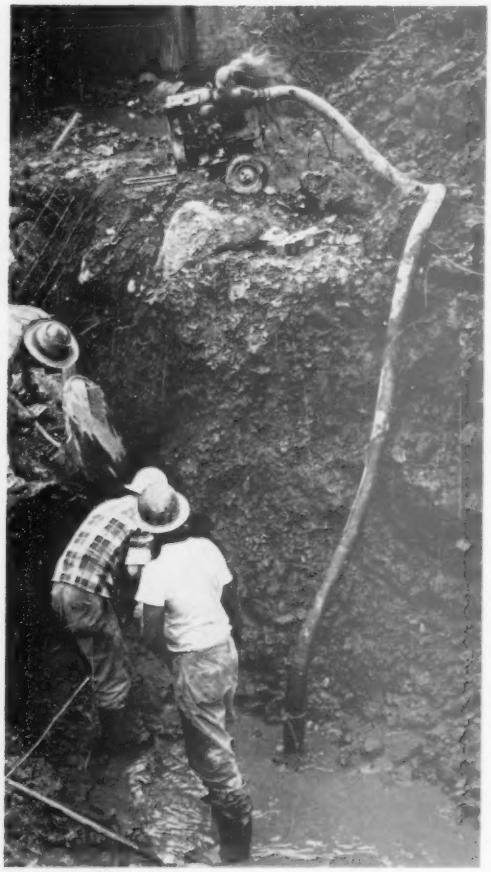
HALLIBURTON FRACTURING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

Odessa; John C. Pruett, from Beaumont to Houston as electrical well service supervisor; Dan R. Plattsmier, from store manager to district supply representative at Lake Charles; W. H. Nolen, to Beaumont as electrical well service supervisor; and L. D. McQuaid, to Harvey as a directional-drilling engineer.

E. C. McGarrahan has been promoted from senior project engineer as chief project engineer at Houston; W. D. Long, Jr., named field salesman at Harvey; John R. Littrell, directional-drilling engineer at Long Beach; James A. Knott, field salesman at Casper; John A. Kennedy, from Victoria to McAllen, Tex., as a fishing-tool supervisor; F. E. Howell, rental salesman at Odessa; Boyd Hebert, from store manager to district supply representative at Morgan City; W. L. Harrison, from McAllen to Alice as a fishing-tool supervisor; Wren Harrelson, export salesman at Houston; D. E. Hampton, from Bakersfield to Ventura as a directional-drilling engineer; C. J. Erwin, from Odessa to Midland as division manager; W. J. Cooper, from Alice to McAllen as a fishing-tool supervisor; and J. W. Brothers, field salesman Kimball, Neb.

Handle the toughest Pumping Job with Ease!



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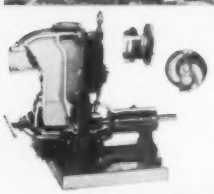
EXTRA HEAVY DUTY
Pumps for Contractors

Completion dates . . . equipment failure . . . bad weather . . . water problems . . . headaches that harass as you push to get the job done. You just can't afford to have trouble.

Dependability takes on its full meaning when these rugged Gorman-Rupp Pumps are on the job. Simple design, rugged construction—and the performance, even under the brutal treatment, is completely reliable. You know you can keep the toughest jobs going with these extra heavy duty units.

See these pumps at your Gorman-Rupp Distributor. They're built to serve you for years.



Fast-Action End Plate — Exclusive Design. Releases for access to impeller and renewable wearplate. Two-vane open impeller handles solids.

THE GORMAN-RUPP COMPANY
309 Bowman Street Mansfield, Ohio
Mid-continent & Gulf Coast Oil Field Representative:
HENRY H. PARIS DISTRIBUTOR INC., Houston, Texas

Tex-Tube, Inc. opens office

. . . in Amarillo to serve the Texas Panhandle area, and names Thomas J. Nance as Panhandle division manager. In connection with this expansion, the firm also added a stocking point in Perryton, Tex., to assure an adequate supply of tubular goods for distribution in the area.

Nance's experience includes employment with Humble Oil & Refining Co. and with San Jacinto Oil & Gas Co. Prior to his appointment in Amarillo, he was a field engineer in Tex-Tube's Houston headquarters.

Anco Mfg. & Supply is awarded

. . . a contract for engineering, design, and construction of a propane-gas terminal at West Memphis, Ark., to be constructed for Tamak Gas Products Co. The terminal will have an initial capacity of 600,000 gal., and ultimate capacity of 2,000,000 gal.

SCHOLARSHIP GRANT is presented to Dr. Logan Wilson (right) president of the University of Texas, by W. S. Althouse, Jr., trustee of the R. C. Baker Foundation. The grant is part of an annual scholarship program, totaling about $85,000, to be distributed among 15 colleges and universities. The foundation is a nonprofit organization established in 1952 by the late R. C. Baker, founder of Baker Oil Tools, Inc. Under the program, scholarships will be awarded to promising students majoring in the fields of science, business administration, and engineering. Schools listed in the program include: California Institute of Technology, University of Southern California, Stanford University, University of California, University of Oklahoma, Agricultural & Mechanical College of Texas, Texas Technological College, Louisiana State University, Louisiana Polytechnical Institute, Colorado School of Mines, Rice Institute, University of Tulsa, Southern Methodist University, University of Houston, and University of Texas.

Resin Applicators, Inc. acquired

. . . by Centriline Corp., New York City, a wholly owned subsidiary of Raymond International, Inc. Resin Applicators, of Newark, specializes in repairing oil-storage tanks with epoxy resins. The Newark firm uses special methods for sealing riveted tank seams, repairing corroded tank bottoms, and protecting shells and roofs. Centriline Corp. is a specialist in lining old and new pipelines with cement or epoxy resins.

Earl Stanger becomes manager

Earl Stanger

. . . of Republic Supply Co.'s Illinois district, reports C. J. Jump, Republic's general sales manager. Stanger joined the concern in 1953 as a field representative at Seminole, Okla. He has served in sales and management capacities at Tulsa and Healdton, Okla., and at Ellinwood and Wichita, Kans. Prior to employment with Republic, Stanger was with Continental Supply Co., B & W Inc., United Supply, and Bovaird Supply.

At the same time, Republic's Rocky Mountain area district manager, Ray Prater, announced the appointment of Kenneth Stone as field sales representative at Farmington, N. M. Stone went to Republic in 1956 and served with the financial department in the headquarters office until his transfer to Houston and later to Farmington. He was formerly with Oklahoma Supply Co. and Hogue-Stone Co. both of Oklahoma City.

National Supply Co. appoints

. . . the following new store managers in the company's northwest division: James B. Allen, Jr., Williston, N. D., succeeding Dwight A. Reams, who was transferred to Denver as a city sales representative; Philip R. Adkinson, Kevin, Mont., succeeding Allen; and Jack Lee Radden, Glendive, Mont., succeeding K. M. Kennedy, who was transferred to the Williston store.

Tex-Tube, Inc. appoints

. . . William H. (Bill) Cottle to manager of the newly formed Mechanical Tube & Special Products Division. At the same time, Robert (Bob) Gajeske, Jr., was named inside-sales supervisor for the division. The new division handles sales of all Tex-Tube mill products for nonpressure applications.

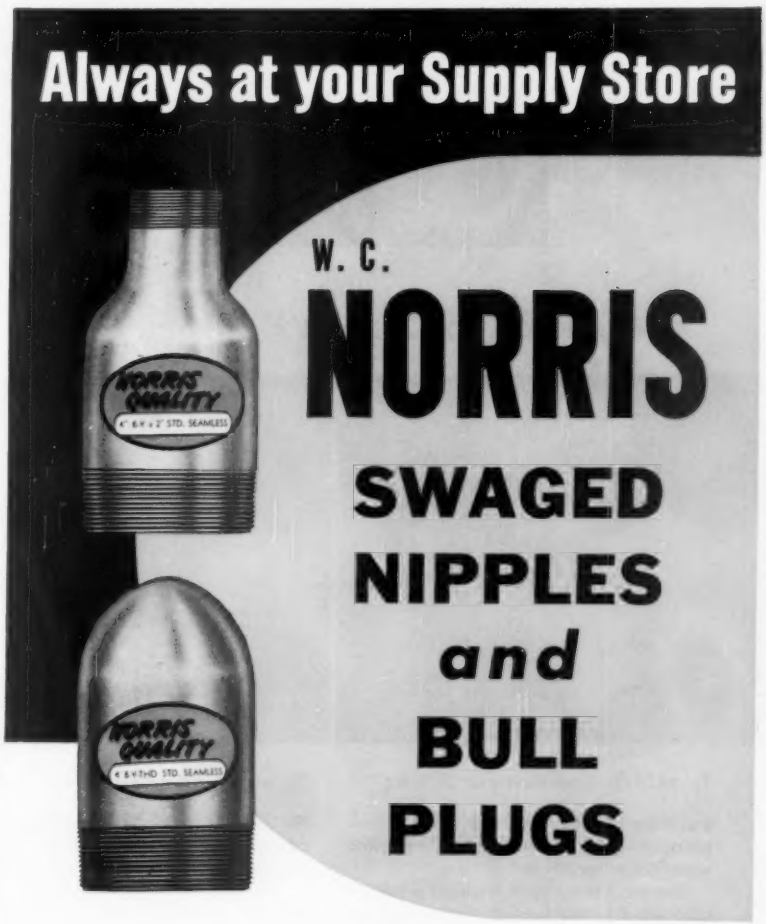
Cottle has been with Tex-Tube since 1958. He formerly served as production manager for a farm-implement manufacturer for 10 years, and as manager of steel sales for Vinson Steel & Aluminum Co. for 2 years. Gajeske joined Tex-Tube 5 years ago in the general sales department.

Two representatives appointed

. . . by Oil Well Supply Division of U. S. Steel Corp., reports Mark Barkhurst, the division's Mid-Continent area manager. Frank James, Jr. takes over as district representative at Great Bend, Kans., and James A. Brunnemer as field representative at Liberal, Kans.

James was employed by Oilwell in 1952 at Oklahoma City. He was transferred to Seminole, Okla., in 1953 and to Pawhuska, Okla., in 1955, being named field representative at the latter location. James became store manager at Hill City, Kans., the following year.

After joining the division in 1946 at Ellinwood, Kans., Brunnemer was transferred to Russell, Kans., and later appointed store manager at McPherson, Kans. He served in this capacity at El Dorado and at Arkansas City, Kans., before becoming field representative at the latter location 6 years ago.



Safety . . . craftsmanship . . . durability . . . precision . . . yes, these elements are important in Swaged Nipples and Bull Plugs. And, these are the elements found in *all* W. C. Norris fittings—elements proven by the experience of our customers.

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DIVISION OF DOVER CORPORATION
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BRANCHES: Great Bend, Kansas; Corpus Christi, Houston, Kilgore, Odessa, Wichita Falls, Texas; Oklahoma City, Oklahoma; Salem, Illinois; Casper, Wyoming; Farmington, New Mexico; Edmonton, Alberta, Canada.

Buy From Your NORRIS Distributor

tie-in a 12″ line . . . SAFELY and SIMPLY!

1. attach line stopper fitting . . .

Position the two halves of the line stopper around the pipe and tack weld together.

Rotate fitting to a vertical position and weld to the line. Pressure test the completed installation, checking the welds for leakage.

2. stopping machine valve

Mount the specially designed Mueller Stopping Machine Valve on the line stopper fitting and bolt securely.

This valve is the primary control feature in Mueller No-Blo line stopping operations.

3. drilling the pipe

Mueller CI-36 Drilling Machines make short work of cutting through the existing 12″ line. The cutter is automatically powered by auxiliary air or gasoline engine drive units.

Upon completion of the cut, retract the shell cutter, close the gate valve and remove the drilling machine.

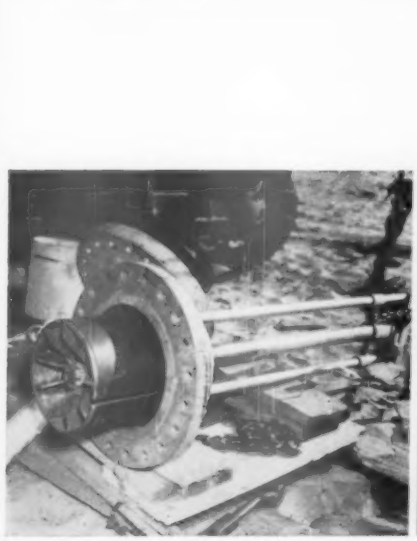
A special ball-detent on the pilot drill securely holds the pipe coupons in the cutter during removal.

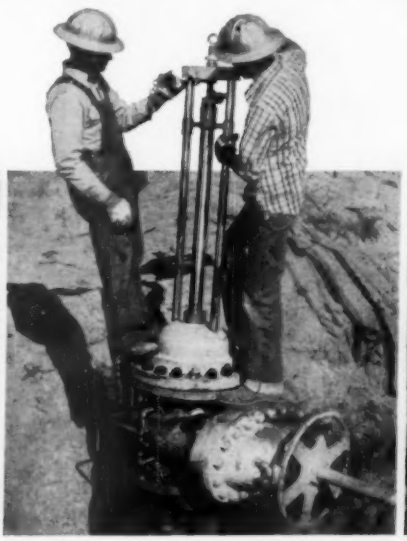
MUELLER NO-BLO METHOD

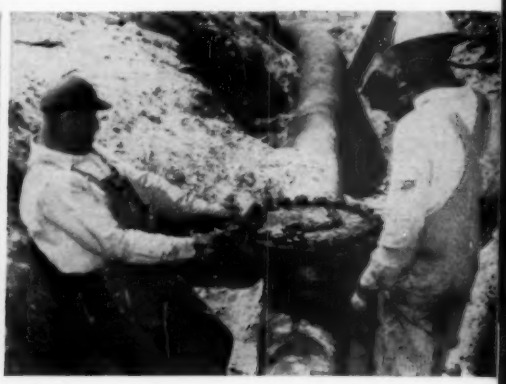
a safe method for isolating line sections!

. . . *tie-ins* of new or larger lines to existing 10″ and 12″ lines are a simple matter with a Mueller No. 4 Line Stopper Unit. Two stopping machines are used to stop-off the line and completely isolate a short section while the new line is tied-in. An independent bypass line, installed around the two line stoppers and bypassing the isolated section, maintains uninterrupted flow during the entire operation. Tie-ins are completed in absolute safety without loss of line fluid.

Mueller Line Stopper Units and companion Drilling Machines are available for pipe sizes ¾″ through 12″. Contact your Mueller Representative or write direct for complete information.







4. prepare line stopper

Fasten the precision Mueller steel wedge stopper onto the line stopping machine.

The expandable steel stopper will slip into the precision cut made in the line by the CI-36 and shell cutter.

5. insert the stopper

With the upstream and downstream pressure balanced, insert the steel wedge stopper into the pipe and fitting.

The Mueller Line Stopping Machine guides the stopper into position and expands it, forming a solid, leak-proof plug in the line, while the bypass carries the flow.

6. secure completion cap

Upon completion of repairs to the isolated section, remove the steel wedge stopper, activating the new line section, safely and easily.

Remove the Line Stopping Machine and insert the Mueller balanced pressure completion plug into the line stopper fitting.

Bolt the completion cap in place, finishing the stop-off operation.

• *If you have any line relocations, repairs, tie-ins or other operations requiring temporary stop-offs of line fluid, contact Mueller Co. for complete engineering service on your particular application. Ask about Mueller's complete line of No-Blo Methods and Machines.*

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Factories at: Decatur, Chattanooga, Los Angeles
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This sprocket used to be machined from a flat pancake forging

Now Bethlehem forges it as shown—
and reduces manufacturing cost
by $29 per piece!
This 27-lb forged sprocket costs less
than the flat pancake forging did.
Our customer not only saves
on the cost of the metal,
but almost all* the machining cost, too.
Perhaps we can do the same for you.
Call or write our nearest sales office.

*The only machining our customer does is finish the bore, and take light cuts on the outside tooth contour. Bethlehem can forge to the contour of sprocket teeth, if an as-forged surface is satisfactory.

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BETHLEHEM STEEL

BETHLEHEM STEEL

Ten-well test slated for Mississippi

IT HAS BEEN ANNOUNCED that a 10-well wildcat drilling program will be undertaken by Justiss-Mears Oil Co., Inc., of Jena, La., and D. C. Latimer, West Jackson, Miss., in Amite and Pike counties, southern Mississippi.

Reportedly all 10 of the wells will be drilled on acreage obtained by farmout from Pan American Petroleum Corp. For each location, Pan American will contribute 160 acres and $49,650 bottom-hole money. The wells will average approximately 11,800 ft. in depth, and it is planned that two rigs will be used to complete the 10-well program.

The locations have not yet been disclosed, but it has been reported that Jet Drilling Co., Shreveport, La., is moving a rig from Gillsburg field to the first location in Pike County.

Here are details on busy drilling areas

LOUISIANA

WEEKS ISLAND, Iberia Parish.

Pay: Multiple Miocene Sands, 14,600 ft.
Approx. cost of well: Flowing $285,000; Dry hole $195,000.
Cost averages: Footage price $6.00
Day: With pipe $1,800; without pipe $1,600.

Normal Rig-Time Distribution

% on footage rate	80	Total days	57
% on day rate	20	Total bits	40

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	2,500	300
Oil string	7	TD	500

Typical Mud Program

Barite (sacks)	3,000
Gel and clay (sacks)	200
Thinners & Misc. (lb.)	35,000
Oil (bbl.)	500

Core Data

Miocene: Interval (ft.), 10,000-18,000; permeability (md.), 200; porosity (%), 16-28; variable residual oil saturation and total water saturation; gas expansion or water drive, variable.

CALIFORNIA

WILMINGTON, Los Angeles County

Pay: Upper Terminal, 3,600 ft.
Approx. cost of well: On pump $85,000.
Cost averages: $5.25
Day: With pipe $876; without pipe $876

Normal Rig-Time Distribution

% on footage rate	80	Total days	15
% on day rate	20	Total bits	5

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	354	*195
Intermediate	9⅝	3,000	†165
Oil string	6⅝	3,600	.....

Note: cement:perlites:gel 1:1:2%.
*+48¾ sacks perlites. †+41¼ sacks perlites.

Typical Mud Program

Clay-water mud
Clay-water mud
Oil Base

Avg. Formation Tops (Drlg. depth, ft.)

Tar	2,150
Ranger	2,350
Terminal	2,900
Union Pacific	4,100

Core Data

Tar: Interval (ft.), 110; permeability (md.), 1,600; porosity (%), 36; gas expansion, 240.

Ranger: Interval (ft.), 250; permeability (md.) 1,000; porosity (%), 37; gas expansion, 210.

Terminal: Interval (ft.), 650; permeability (md.), 750; porosity (%), 32; gas expansion, 360.

Are tool pushers a vanishing breed?

THE TOOL PUSHER of the past is becoming a rare bird. Mostly through evolution, the old rough and ready, "whip his weight in wildcats" individual is passing from the scene.

What has happened to him? Many factors have entered the picture, resulting in his promotion, retirement, and replacement by a new breed of specialist. This is the day of the specialist and yet the tool pusher of yesteryear was a very versatile person.

Among his duties were the hiring, training, and supervision of his crews. He was responsible for their safety, morale, and general well-being. The rig and its auxiliary equipment was operated, maintained, repaired, and moved under his direction. In varying degrees he was in charge of purchasing, keeping records, arbitrating conflicts, personnel evaluation, solving mechanical problems, and was a technician and all-around troubleshooter.

He could be compared to a small-factory plant manager. For example, on a heavy-duty Gulf Coast-type rig he is responsible for up to nearly a

"SCOT" FORGED SEAMLESS RING GASKETS

MINIMUM HARDNESS

Ask for "SCOT" Gaskets at your Supply Store.

For ring Groove Flanges forged from reforging billets in the following materials in stock: Soft Iron, Copper, Aluminum, Inconel, Monel, Nickel; 1¼ Cr ½ Mo., 2¼ Cr 1 Mo., 9 Cr 1 Mo. 304, 310, 316, 321, 347, 405, 410, 430, 502, 304L, 316L, Nickel L.

Machined in all A.P.I.—A.S.A. Special sizes and other type, Including BX.

SOUTHERN CALIFORNIA OIL TOOL COMPANY
8220 Atlantic Boulevard
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Hooking a Sauder Type T Pressure Treater into your line gives you: 1, an Oil and Gas Separator. 2, a Free-Water Knockout. 3, a Preheater. 4, a Pressure Emulsion Treater — ALL IN ONE!
— And adjusting the water level is no longer a shutdown problem! Sauder's quick water level adjusting control adjusts in minutes . . . without taking treater out of service! Backed by 35 years of specialized oil field service!

4 ADVANTAGES IN ONE!

type T treater

Write or Phone for Complete Information

Sauder

SAUDER TANK CO., INC. • Phone DI 2-2550 • Emporia, Kansas

million dollars worth of equipment. Depending upon the specific equipment, he may have 15 to 20 men under his direction. The manner in which his unit performs makes the difference between a profit or loss if his company is a contractor.

His talents appear unlimited. He becomes expert in penetration rates, bit types most suitable, stratigraphy, mud problems, and bears the brunt of attack of an arduous fishing job. He is an exterior dectorator, welder, electrician, mechanical engineer, chemist, physicist, geologist, metallurgist, businessman, and soothsayer—all of these to some degree. He has learned his vocation in the hardest and most impressive manner—by experience.

He started usually as a helper on the floor and worked his way up through the ranks. He learned mostly by doing and it was seldom that he could profit by watching without participation.

His prime purpose is to complete the fastest, straightest, best-conditioned hole in the minimum amount of time and cost. The best job he can do is to achieve his total depth with a minimum of problems. His is truly the work of an efficiency expert from the old school.

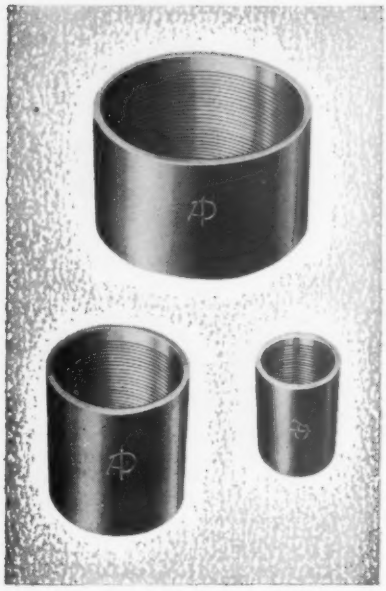
The old-time tool pusher is not entirely gone from the scene. Today you will meet him behind a desk fulfilling the position of an executive, an officer with his firm, and doing a fine job in a role he has had all along; a successful business man.

In the field he is being replaced by an engineer. This is not an altogether overspecialized job any more than it was in the past. The job is primarily the same with similar problems. The only difference now is that the man in the field has the advantages of experience and training; a combination designed to cut down on the time required to peak the individual's performance.

A trend is apparent that the present-day tool pusher will not have to go it alone as much as his predecessor did. He will be able to call upon more outside help to solve some of his headaches. Primarily his job is comparable because the decisions are his and will have to call his shots as he sees them. One factor that will help him is the technology advancements that have evolved over the years.

Some of the leaders and most successful men in the petroleum industry today are proud of their past training as pushers. Much of their progress, they'll modestly admit, is because they're "an up-from-the-ranks tool pusher," a vanishing species.

—Peter B. Bike



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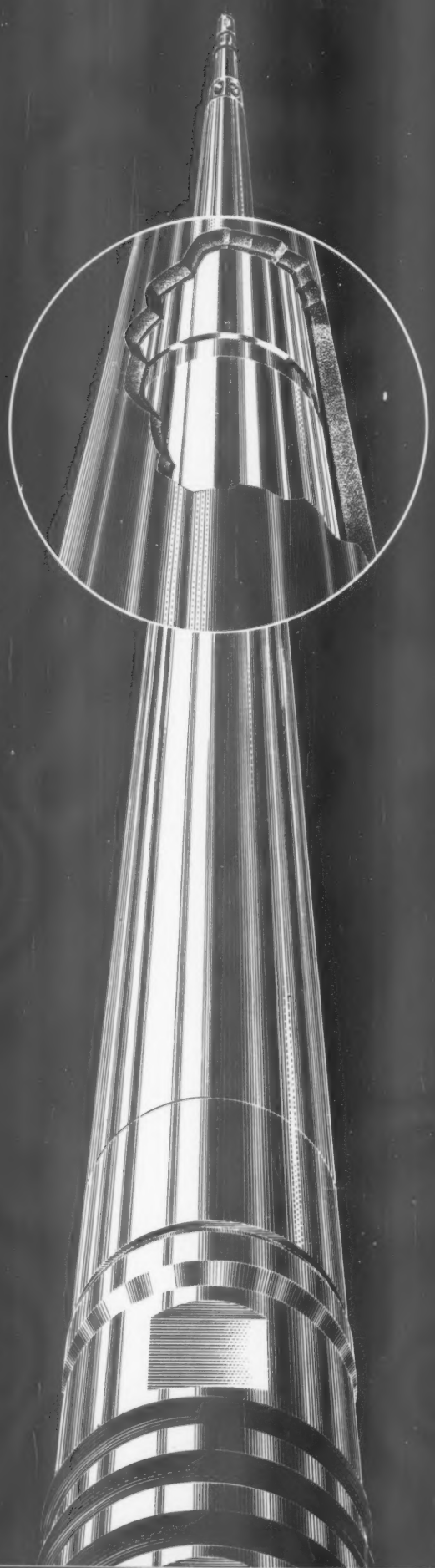
Economy of installation is apparent when the Oilmaster Bottom Hole Assembly and the parallel string are run and landed independently at a small fraction of the rig time required to run a clamped string.

Economy of operation pays out with the trouble free and efficient operation of the Oilmaster unit.

Economy of maintenance becomes a reality when the Oilmaster Free Type Unit is surfaced hydraulically—then repaired by qualified personnel in well equipped, strategically located pump shops.

Ask your Oilmaster representative to give you details on this economical method of production, or write for Bulletin E5903.



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Since 1936 the Oilmaster Volume Producer has been acknowledged leader in pumping fields the world over—frequently copied but never equalled.

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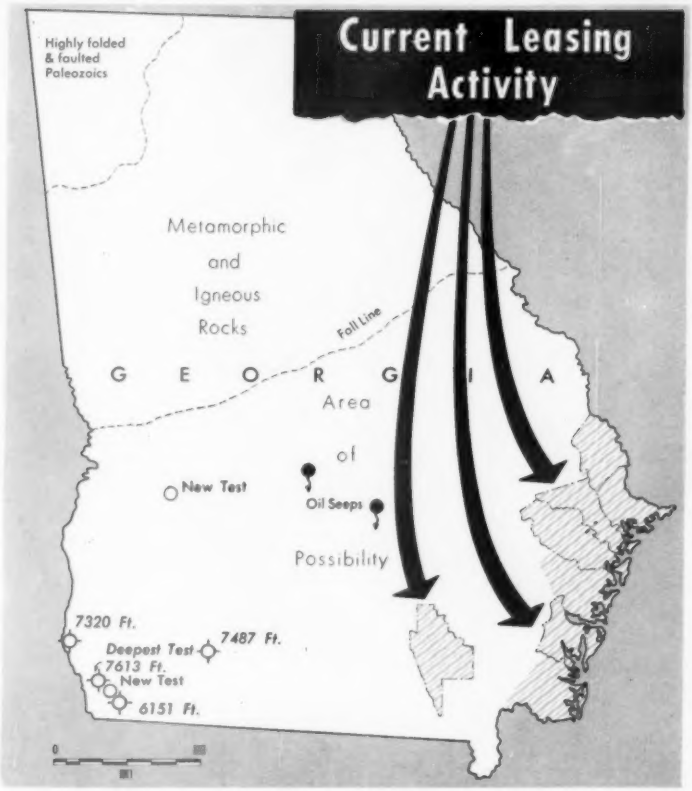

GEORGIA HUMS with oil talk these spring days, as plans for more than a score of wildcats shape up in the southeastern counties. This, plus the announcement of two new tests in the southwest, adds up to a busy year ahead in the Cracker State.

Georgia gets set for "the big push"

BY FRANK J. GARDNER

THINGS are perking up in Georgia. For a state that has yet to produce its first drop of oil, its activity outlook is unusually bright for the coming months.

In a continuation of an exploratory program that began in South Carolina last year, a group of Houston oil men, under the leadership of Geologist Roderick A. Stamey, expects to launch a broad program of drilling in the coastlands of Georgia some time this summer. At the moment, the operating group is still inking leases, with the goal set at 250,000 acres; when that's done, the first drilling in a 20 to 40-well search will get under way. The target date for spudding is now tentatively set for July 1.

Southeast . . . This Houston oilliance has set its sights principally upon the coastal counties. And once exploration gets going, Savannah will be the oil capital of the state. This will be the first sustained campaign ever undertaken in Georgia. Sporadic drilling through the years has seen only 81 legitimate wildcats placed on record there; of these, 57 were drilled prior to 1954, 9 in 1954, 4 in 1955, 9 in 1956, 1 in 1957, 1 in 1958, and none in 1959.

Besides the Stamey group, Humble Oil & Refining Co. is in the play. This big operator has totted up half a million acres and drilled about 200 core tests in Ware, Glynn, Brantley, Wayne, and Long counties.

Or southwest . . . But across the state, other operators have become openly optimistic about the chances for oil. In the southwestern counties, notably Seminole, Decatur, Early, and Miller, both majors and independents are on a leasing and drilling push. Two new wildcats have already been spotted in this part of the state, scene of Georgia's deepest drilling (see map). One will be drilled northwest of Americus by Ernest Hill, Houston independent, and the other (by J. R. Sealy) will lie 18 miles west of Bainbridge (OGJ, March 28, 1960, p. 101). Humble is also well represented in this southwestern play, as is Sun Oil Co.

Conversations with Capt. Garland Peyton, director of the State Department of Geology, Mines, and Mining, confirm all this new interest in his state. "This is the biggest thing ever to hit Georgia in the way of oil prospecting," he declares, "and the influx of Texas wildcatters may mean we'll finally find some oil."

The chances are good . . . The section in the southwestern corner of the state is at least 8,000 ft. thick, while in the coastal region, it might attain an equal thickness, especially offshore. Numerous shows of oil have been reported from wildcats of earlier vintage, and several oil seeps have been noted at the surface. The evidence is all there.

Operators feel that the best chance of success lies in the Tuscaloosa-Upper Cretaceous sand (Woodbine equivalent), in the Trinity-Lower Cretaceous, and in wedgeouts at the Jurassic-Cretaceous unconformity.

Deep tests in the coastal area have been fewer than in the Southwest. But some idea of what might be cut by the bit in coastal drilling can be gleaned from the log of a wildcat drilled in Liberty County a few years ago. Tops in that well included the Claiborne-Eocene 1,034 ft., Wilcox-Eocene 1,517 ft., Midway - Eocene 1,956 ft., Upper Cretaceous 2,237 ft., Eutaw - Upper Cretaceous 3,082 ft., upper Tuscaloosa 3,473 ft., and basement rhyolite porphyry 4,250 ft.

Georgia's legislature is all for the oil man. It has done everything possible to encourage him to take a chance there. This includes a state bounty of $250,000 for the first 100-bbl. well. In addition, the lawmakers have authorized a survey of Georgia's offshore lands, when and if the surveyor general can get hold of the money. So far, he hasn't. But should one of Stamey's wildcats claim the prize money, rest assured the surveyor general will claim his, and in a hurry.

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comes in oceans, rivers, lakes, wells,
drops, buckets, pitchers and glasses.
it quenches thirsts, cooks food, puts
out fires, makes coffee and
brushes teeth. it spins mills,
runs electro-plants, cools motors
and power factories.
it spawns fish, sprinkles lawns,
floats boats, washes children
and grows flowers.

it sustains and nurtures.
it bends if you give it purpose.
it reshapes itself if you give it reason.
it is needed, wanted, feared,
praised and prayed for.

it is at the heart of all life.
it is in the arteries of all industry.
it is as close to us as skin
but as taken for granted as sky.

the end of water seems unbelievable.
if it is not on the horizon, it is just over it.
if it is not within sight,
it is just 'round the bend.
if it is not in the glass,
it is just in the spigot.

. . . this is the grand mirage . . .
the self-delusion that prevails
though the wells run low
and the streams go dry
and the water slips away.

we know water.
we know its ways.
we've learned its habits.
we've pulled it out of swamplands,
pushed it over mountains,
pumped it into deserts,
tunneled it through granite,
and rescued it from pollution.

above all else,
we know the need for it.
that is why,
for 130 years,
we've developed new uses for,
powered new factories with,
diverted the courses of
and jealously stood guard over
water.

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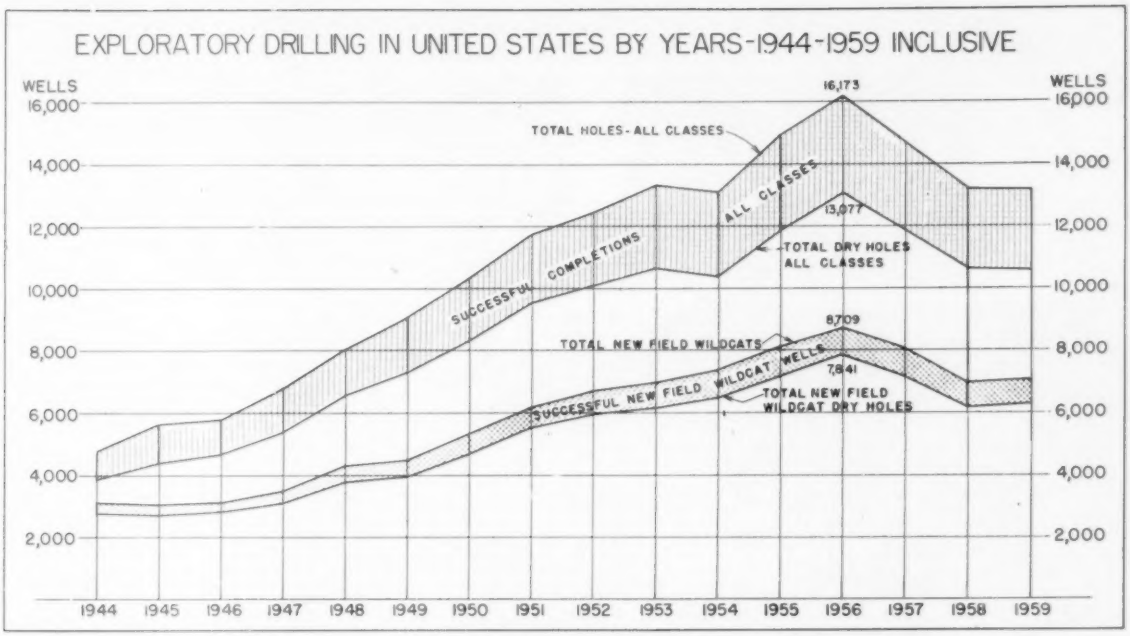


THE PEAK YEAR for successful completions in the United States was 1956. Recovery may occur after the decline years of '57 and '58 in last year's figures. This is the third year that B. W. Blanpied has prepared this report for the AAPG.

AAPG tallies three-nation exploratory drilling results

BY B. W. BLANPIED

. . . geological consultant for Gulf Oil Corp. since his recent retirement. Blanpied has been with Gulf since 1922 in varied capacities including: geologist, chief geologist, manager of exploration, and division staff geologist. Prior to joining Gulf, he was with Empire Gas & Fuel Co. and Pure Oil Co. He is chairman, AAPG Committee on Statistics of Exploratory Drilling.

THIS REPORT, the fifteenth based on data gathered by the Committee on Statistics of Exploratory Drilling, is the twenty-fourth annual summary on the subject. Frederic H. Lahee prepared this statistical analysis and wrote the annual article for 20 consecutive years. Graham B. Moody prepared the report for exploratory drilling for 1956. This is the third report for the present chairman.

During 1959, 13,191 exploratory holes were drilled in the United States. Of these 7,031 were new-field wildcats, 3,355 were new-pool tests (including new-pool wildcats, deeper-pool tests, and shallower-pool tests) and 2,805 were outposts. Among the new-field wildcats, 772 were successful, among the new-pool tests 941 were successful, and among the outposts 901 were successful.

The total exploratory footage drilled in the United States in 1959 was 63,252,521 ft. in the 13,191 holes, or 4,795 ft. per hole. These figures compare with 61,483,911 ft. drilled in 13,199 exploratory holes, with average depth of 4,661 ft. in 1958.

For the first time data are presented on natural-gas reserves in the 17-state area by years, for discoveries having 6 years or more of development history.

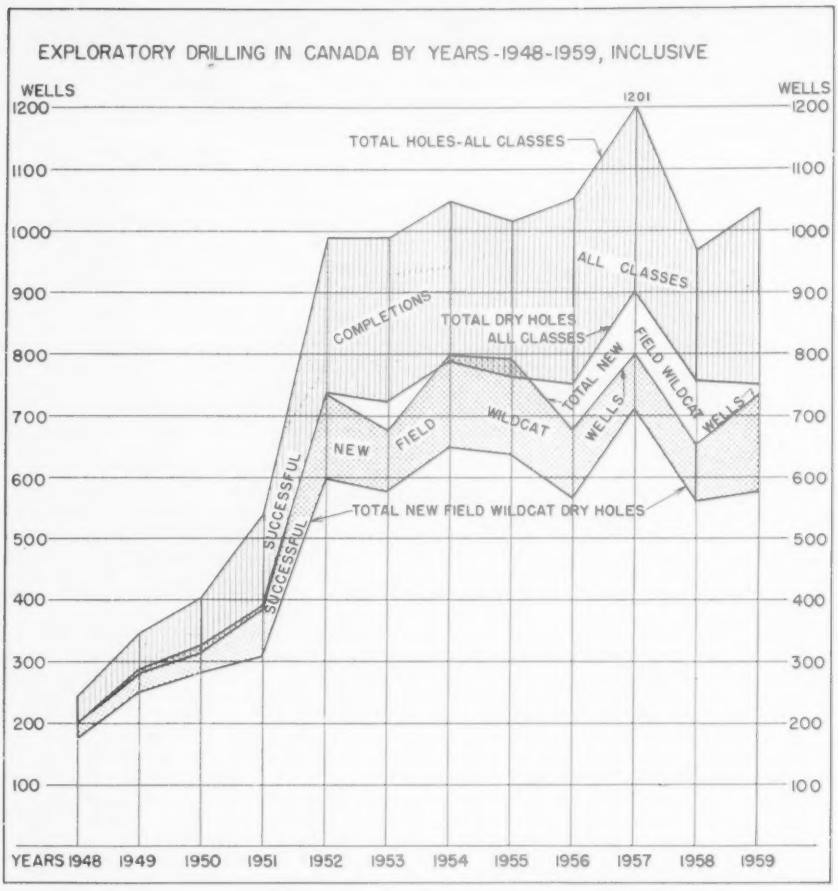
For the twelfth time, data are presented on Canada and Mexico.

The committee has continued to use the classification of exploratory holes as outlined in Table 1. The same classification is also used in Canada and Mexico. All holes are grouped according to their preliminary classification (I in Table 1) whether or not their original objective is attained. Under this classification (I), the holes are then grouped according to their completion classification (II in Table 1). It is to be noted that, while most outposts, or, as we may also call them, "extension tests," if successful, are completed as extension wells, some discover new pools or pay, and therefore are completed as new-pool discovery wells. Similarly, any type of new-pool tests, if successful, may be completed as an extension well rather than as a new-pool discovery well. These possibilities are indicated in parenthesis under Col. B, 2a, 2b, and 2c, in Table 1.

Except where otherwise designated, the statistics recorded in the present report are similar to those used in the reports from 1939 to 1958, inclusive.

All holes drilled may be grouped as (1) those drilled for oil or gas, or (2) those drilled for other purposes. All holes drilled for oil or gas may be classed as (1) those which are field-development wells, located within or close to the developed part of an oil pool or gas pool (within the area of proved reserves), and drilled further to develop the pool or pools already partly developed; or (2) those which are exploratory in the sense that they are searching for new and as yet undiscovered pools or are searching for long extensions of pools already partly developed. We are concerned here only with the exploratory holes.

All exploratory holes are drilled either on structures not yet producing, or on structures already producing. Holes of the first of these two



CANADA peaked its exploratory drilling in 1957. After a setback in '58, its recovery may indicate that new records are possible in the future.

classes are new-field wildcats. Occasionally, where structures are poorly defined and porosity varies considerably within relatively short distances, exploratory holes may be classified as new-field wildcats if they are 2 miles or more distant from the nearest production. Holes of the second class (on structures already producing) may be outside the developed area (area of proved reserves)[1] in which case they will be either outposts or new-pool wildcats according to whether they are drilled to extend a partly developed pool (reservoir) or to explore for a new pool. Holes of the second class may also be within the proved developed area of the pool, in which case they may be deeper-pool tests, exploring beneath the deepest known pool penetrated by the hole, or shallower-pool tests, exploring for a new pool above the deepest developed pool at the site of the well in question. There are very few exploratory holes that belong to this last class, i.e., shallower-pool tests. Most of the wells of this kind are field-development wells that happen to find new shallower pools. In other words, such holes were not drilled for the purpose of exploring for a shallower reservoir. Only rarely is such exploration undertaken, and then usually when suggestions of lensing or faulting indicate that there may be a chance for a shallower accumulation.

Note that an exploratory hole, as here defined, retains its classification if it is abandoned as dry, whether or not it is carried to the depth originally scheduled for it. Also note that a core hole or a stratigraphic test (the one drilled for structural correlation purposes and the other drilled to ascertain stratigraphic sequence) is regarded as an exploratory test for oil when, and only when, it is drilled with the definite intention of completing it as a producer if oil or gas is found

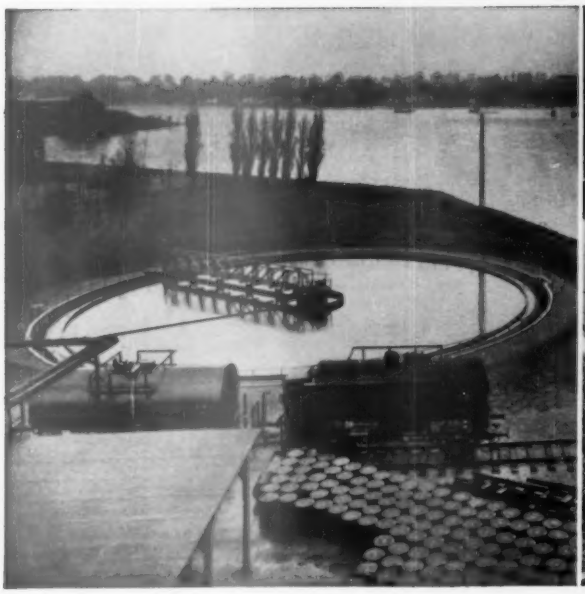
TABLE I. CLASSIFICATION OF EXPLORATORY WELLS

				I. *Classification When Drilling Is Started*	II. *Classification after Completion or Abandonment*	
					Successful	*Unsuccessful*
				A	B	C
Drilling for lone extension of fairly developed pool				1 Outpost (Extension test)	1 Extension well (Sometimes a new-pool discovery well)	1 Dry outpost (Dry extension test)
Drilling for a *new pool* on a structure or in a geological environment already productive	New-pool tests	Drilling within limits of proved area of pool	For new pool *above* deepest pool	2a Shallower-pool test	2a Shallower-pool discovery well (Sometimes shallower-pool extension well)	2a Dry shallower-pool test
			For new pool *below* deepest pool	2b Deeper-pool test	2b Deeper-pool discovery well (Sometimes deeper-pool extension)	2b Dry deeper-pool test
		Drilling outside limits of proved area of pool		2c New-pool wildcat	2c New-pool discovery wildcat (Sometimes an extension well)	2c Dry new-pool wildcat
Drilling for a *new field* (on a structure or in an environment never before productive)				3 New-field wildcat	3 New-field discovery wildcat	3 Dry new-field wildcat

(Or, in places, extension wells)

Dry new-pool tests

round square rectangular



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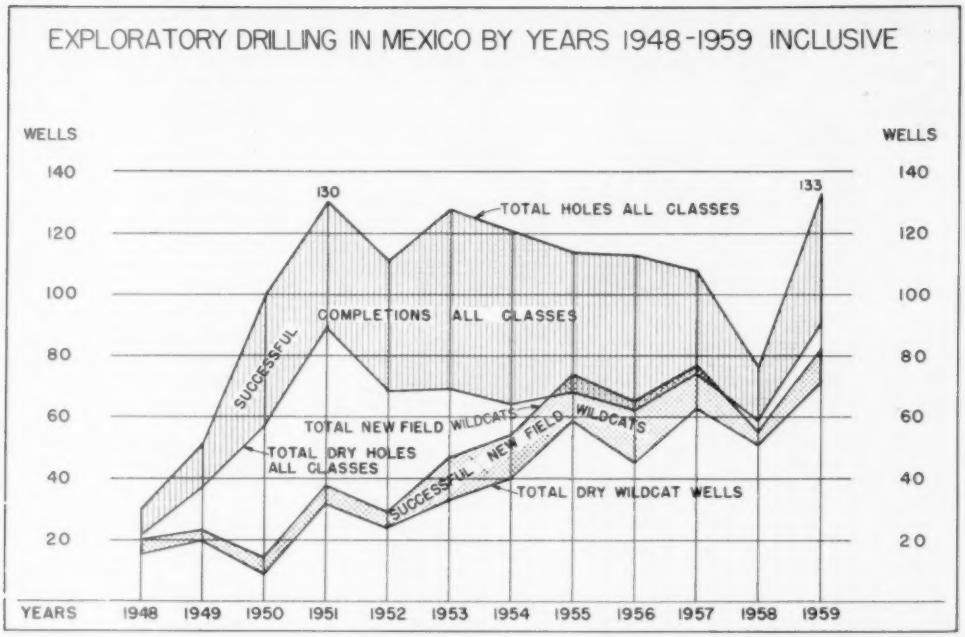


MEXICO had its best year in 1959 and it peak year is not yet in sight. An interesting aspect is that its best previous year for total completions was 1951.

in it, and only if it is drilled in such a manner that such completion is possible.

In the states covered in this review, during 1959, a total of 63,252,521 ft. was drilled in 13,191 exploratory holes, divided as follows:

	Ft.
2,614 Producers	14,576,152
10,577 Dry holes	48,676,369

This means that 19.83% of the holes drilled, and 23.07% of the footage drilled, were successful in 1959. One producer foot was drilled for every 3.33 ft. of dry hole. One successful well was drilled for every 4.04 dry holes. The average depth of hole was 4,795 ft. (a notable increase over the previous year).

Seven hundred and five new-field wildcats drilled on technical advice (geology and/or geophysics) were successful, and 5,242 were dry; 32 holes located for nontechnical reasons were producers, and 494 were dry; 35 producers and 523 dry holes were located for reasons unknown. The figures show that 12.06% of the new-field wildcats drilled on technical advice were producers in contrast to 6.18% successful in the case of holes located without technical advice. Therefore, in 1959, locations for new-field wildcats based on technical recommendations were 1.95 times as successful as those drilled without such advice. Seismograph methods were involved in locating 283 producers and 1,531 dry holes among the new-field wildcats.

New-field wildcats made up 56.15% of exploratory footage drilled.

In 1959, percentage of new-field wildcatting in the entire exploration drilling program was 53.30%. That for new-pool testing was 25.43%, and that for outpost drilling was 21.27%.

As indicated in Table 1, a hole may be located as an outpost with the intention of trying to extend a pool partly developed, but instead it may discover a new pool; and, similarly, a new-pool wildcat may be located in search of a new pool because it is believed to be well outside the limits of the known pool, but instead it may result in extending this known pool farther down than had been expected. Most outposts, if successful, are completed as extension wells and most new-pool wildcats, if successful, discover new pools. Note that 632 outposts were completed as extension wells and 269 were completed as new-pool discoveries; 483 new-pool wildcats discovered new pools whereas 136 new-pool wildcats were completed as extension wells.[2]

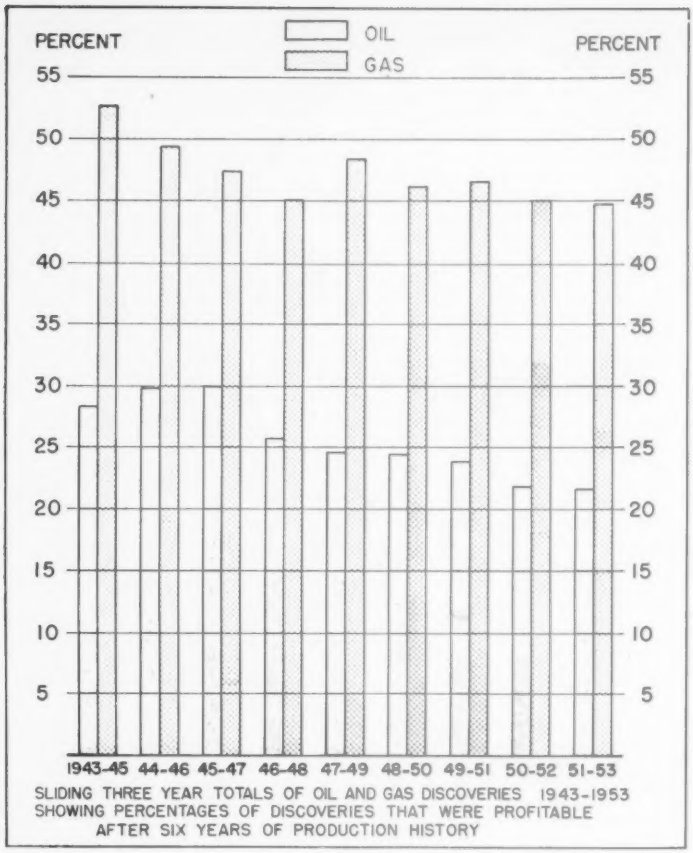
Old wells worked over (OWWO) were important in new-field and new-pool discoveries during 1959. Thirty-one new-field wildcat discoveries included 23 oil, and 8 gas, 1 of which was dually completed gas with oil. Of 32 new-pool discoveries, 19 were oil, 6 gas with 1 dual gas with oil; 1 condensate well, 5 oil and 1 gas well were extensions. Of 17 outpost discoveries, 9 were extension oil wells and 6 extension gas wells; of the outpost wells, 2 were new-pool oil discoveries. Eight OWWO wells resulted in deeper-pool discoveries, six oil and two gas pools. Of 16 shallow-pool discoveries, 10 were oil wells and 6 gas wells, 1 of which was an extension oil-pool discovery.

Exploratory Drilling in Canada

In western Canada in 1959, 905 exploratory holes were completed, 278 of these being producers and 627 being dry holes. The producers included 136 oil wells and 142 gas wells. Altogether, 4,452,852 ft. were drilled—1,515,676 ft. in producers and 2,937,176 ft. in dry holes. This means that 30.72% of the exploratory holes and 34% of the exploratory footage were successful. There were 1.93 ft. drilled in dry holes for every foot drilled in producers. For every producer completed, 2.25 dry holes were abandoned. The average depth of all the exploratory holes was 4,930 ft.

Among the 661 new-field wildcats completed in western Canada in 1959, 144 were successful and 517 were dry. In other words, new-field wildcatting was 21.75% successful. One producer was drilled for every 3.59 dry holes.

In eastern Canada, 131 exploratory holes were drilled, with a total of 238,628 ft. Of the 131 holes, 8 were successful, 3 as oil wells and 5 as gas wells. In these producers, 17,784 ft. were drilled. Of the 131 holes, 6.11% were successful; 7.45% of the exploratory footage drilled was in successful holes. For every foot drilled in



SLIDING THREE YEAR TOTALS OF OIL AND GAS DISCOVERIES 1943-1953 SHOWING PERCENTAGES OF DISCOVERIES THAT WERE PROFITABLE AFTER SIX YEARS OF PRODUCTION HISTORY

IN THE FINAL ANALYSIS of any producing area, prime consideration should be given to whether that area will stand up over a period of time. This chart is presented to show the results after evaluation of a 6-year history.

producers, 12.43 ft. were drilled in dry holes. The average depth of hole was 1,823 ft.

Among the 72 new-field wildcats completed in eastern Canada in 1959, 3 were successful and 69 were dry. In other words, new-field wildcatting was 4.17% successful. One producer was drilled for every 23 dry holes.

Total new-field wildcats in Canada drilled during 1959 were 733, of which 147 were successful and 696 were dry holes. New-field wildcatting for Canada was 20.12% successful during 1959, or one producer for every 4.74 dry holes. Of the 733 new-field wildcats drilled, 710 were drilled on a technical basis as follows:

Located on geology were 69 producers and 210 dry holes.

Located on geophysics were 19 producers and 109 dry holes.

Located on both geology and geophysics were 56 producers and 247 dry holes.

Technical methods, therefore, were 20.30% successful in finding new oil or gas fields.

Exploratory Drilling in Mexico

One hundred thirty-three such holes were drilled, with a total of 983,012 ft. Of these, 42 wells (34 oil producers and 8 gas producers) were successful. This exploratory program was 31.55% successful. The average drilled depth of all exploratory holes was 7,391 ft.

Of the 133 holes, 82 were new-field wildcats which resulted in the discovery of 11 new fields, of which 8 were oil and 3 were gas discoveries (13.41% successful).

Eighty-two new-field wildcats were drilled on a technical basis as follows:

Located on geology were 5 producers and 13 dry holes.

Located on geophysics were 3 producers and 31 dry holes.

Located on geology and geophysics were 3 producers and 27 dry holes.

Technical methods, therefore, were 13.41% successful in finding new oil or gas fields.

Total number of wells drilled in Mexico during 1959 were 441, of which 133 were exploratory and 308 were development wells. Total footage drilled was 3,103,438 ft. of which 983,012 ft. was exploratory and 2,119,426 ft. was development footage. Average depth of all wells was 7,025 ft.

In Mexico during the period 1948-1959 inclusive, a total of 565 new-field wildcat wells, located on a technical basis, have been drilled. Of these wells, 116 were producers and 449 were dry holes. The percentage of successful locations was 20.53% for the 12-year period. Following is the success percentage for each of the three bases used in making new-field wildcat locations for the 12 years.

Located on geology were 23 producers and 87 dry holes for a success per cent of 20.90.

Located on geophysics were 60 producers and 225 dry holes, a success per cent of 21.25.

Located on geology and geophysics were 33 producers and 137 dry holes, a success per cent of 19.43.

Conclusions

The data compiled by the Committee on Statistics of Exploratory Drilling are classified and grouped as nearly as possible under one system, a system which has been widely accepted as standard for many years. From these data, totals are obtained and percentages are calculated, all of which are regarded as the most reliable analysis available, of the results of exploratory drilling for oil and gas.

From these totals and percentages many significant conclusions have been drawn and many comparisons have been made. For example, we can compare the results of exploratory drilling from year to year; or between different states or parts of the country; or between deep holes and shallow holes; or between the holes located on technical advice and those not so located; and so on. Also, any company which adopts our system for its own exploratory program can logically compare its results with those of industry. If it does not conform to our classification, its records are not in any way comparable with our published figures for industry.

Most important are the facts pertaining to the "rank" wildcats, which we call new-field wildcats, the wells which, when they are successful, discover entirely new fields. In the last 16 years in the United States these have comprised approximately 54% of the total number of exploratory holes. For the year of 1959 they comprised 53.20% of the total. Of these new-field wildcats, during this period, the percentage located on technical advice has risen from 77% to

85%. In this same period 2.39 times as many new-field wildcats have been successful when located on technical advice as those not so located. Taking all new-field wildcats into consideration there has been an almost constant success-to-failure ratio. The average for the 16 years has been 11.15%, with a range from a low of 9.97% to a high of 12.22%. That is, one hole in every nine has found some oil or gas.

But even more significant than these figures has been our study of the total ultimate reserves of oil discovered by these new-field wildcats. Briefly, this study, which is based on fields having a minimum of 6 years of development history, shows that on an average only one new-field wildcat out of every 43 drilled discovers a field with 1,000,000 bbl. or more of estimated ultimate reserves; that is, an average of 42 unsuccessful holes are drilled for every profitable field discovered by new-field wildcat wells. The above figures are averages covering fields discovered during the 10-year period 1944-1953 on which we have reserve estimates following 6 years of development history. The ratio of profitable fields to total new-field wildcats shows a steady increase of unsuccessful wells throughout the period. The number of dry and unprofitable holes drilled for each profitable discovery through this period steadily increased from 35 in 1944 to 42 in 1953. Approximately 98% of all new-field wildcats drilled are failures in that they are abandoned as dry or they discover reserves too small, on the average, to be profitable.

These are the facts which have forcibly demonstrated the fairness of and need for the 27½% depletion provision, and in demonstrating this need they have been of inestimable value to the industry, to the government, and to the public at large.

References

1. By "area of proved reserves," we mean the area which definitely may be said to have been proved for future production by the wells already drilled in the pool. This area includes the drilled producing units, those inside units which it is believed will surely produce when drilled, and in pools on reasonably simple structure, those outside units which adjoin the drilled producing units and which, likewise, it is believed will produce when drilled.

2. The new-pool discoveries referred to in this paper are all the result of exploratory drilling. In addition to these, at least 184 new-pools were discovered in the drilling of field-development wells. These included 112 new-pool oil wells of which 1 was dual with gas; 49 gas, 2 of which were dual gas wells, and 21 condensate wells. There were also 3 oil well extension wells. OWWO in development wells found 20 new oil pools, 3 new gas pools and 2 new condensate pools, one of which was dual with oil.

A book, a map, and an abstract for oil hunters

Hugoton reference book released

ONE OF THE LARGEST petroleum reference books ever to deal with a single oil and gas province has just been published by National Petroleum Bibliography, Box 3586, Amarillo, Tex.

The "Hugoton Embayment - Anadarko Basin Handbook," compiled and edited by Curtis and Don Stevens, covers oil and gas activity to the start of 1960 over 60,000 sq. miles in the Texas and Oklahoma Panhandles, southwest Kansas, southeast Colorado and northeast New Mexico.

Illustrated by nearly 150 geologic structure maps, isopachs and cross-sections of fields in the Amarillo-Hugoton area, the 500-page, catalog-size volume carries a wealth of operating information and is designed to serve as a primary source for information on the multipay province.

It is opened by a descriptive summary of past, present, and future activity over the region and includes such data as discovery, geological, reservoir, and field information on some 700 oil and gas fields; a comprehensive, 22-page bibliography of technical references; a detailed classification of sources for operating inforamtion; an alphabetic and geographic directory of operators actively drilling in the area; and a complete list of consulting geologists and engineers headquartered here.

Priced at $25.00 per copy, the new book may be ordered direct from the publisher, on approval if desired.

Kansas map available

Immediate availability of a new geological pay formation map covering Morton, Stevens, Grant, Stanton, Hamilton and Kearney counties in Southwest Kansas has been announced by Interstate Development Maps of Amarillo.

Size is 40x60 inches and scale is 1 inch-8,000 feet. The map is a bluelines print from a film base and is available on either paper or linen. The tool is excellent for coloring and/or wall mounting.

As the only geological pay formation map yet drafted on the area, the new map is large enough to show all wells, both producers and failures, in their true location. Operator and fee is shown on all producers and field names are printed adjacent to the actual producing area described. Coded symbols are used to designate producing horizons of each well and a stratigraphic section with the code is printed as part of each map.

The new geological tool joins previously drafted maps of the same scale and type on the northeast Texas Panhandle and the Oklahoma Panhandle. All three maps are available with posting current to January 1, 1960. All maps are available at Dwight's, 212 West Sixth, Amarillo, Tex.

Here's a report on Montana's Wolf Springs

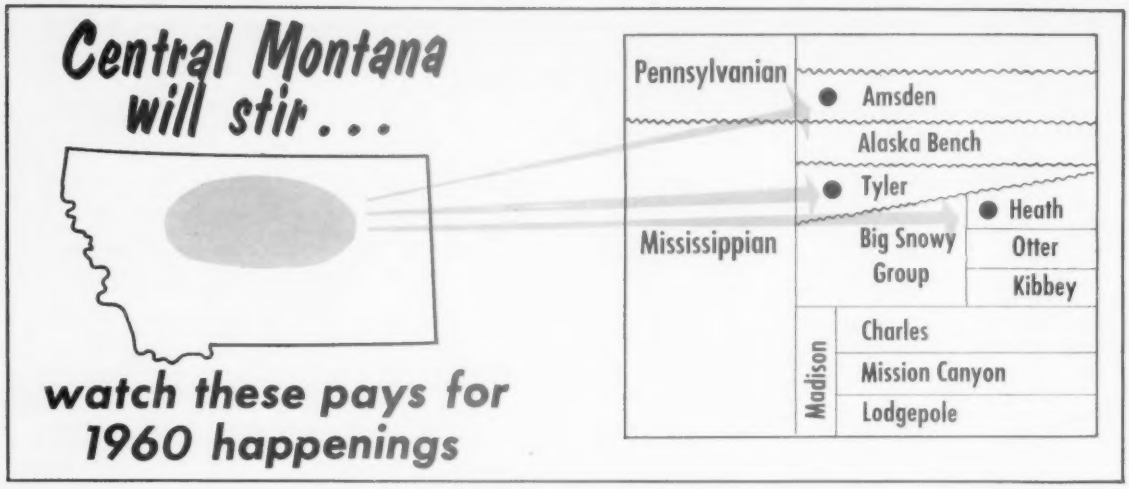
NEW INTERPRETATION FOR WOLF SPRINGS FIELD, MONTANA, by John R. Fanshawe.

Wolf Springs field, 7n-32e, Yellowstone County, Montana, produces 30°-gravity oil from the Amsden Dolomite at an average depth of 6,200 ft. Discovery was made by Atlantic Refining Co. in August 1955.

Prior published comment considers the oil pool to be an accumulation due to hydrodynamic tilt to the northeast of the axis of the Wolf Springs anticline, as contoured on top of the Amsden formation.

Wells drilled during 1959 add regional information which casts doubt on the hydrodynamic thesis. An interpretation is offered whereby the oil-pool localization is shown as being due entirely to stratigraphic factors.

Abstract of a paper presented at the Billings, Mont., meeting of Rocky Mountain section, AAPG, February 1960.



Here are 11 good reasons why Central Montana will stir:

1960 DISCOVERIES

1. Ivanhoe Dome: Winston L. Cox 1 NP, Musselshell County. IPF 277 bbl. per day. Amsden-Pennsylvanian. New pay for field opened in 1956 with Morrison-Jurassic and Tyler-Mississippian production. Field has 13 producers.

1959 DISCOVERIES

2. Hawk Creek: Atlantic Refining Co. 1 Harvey, Musselshell County. IPP 33 bbl. per day. Amsden extension to 1958 discovery. Field has two producers.

3. Stensvad: Honolulu Oil Corp. 11-11 Fee, Rosebud County. IPF 568 bbl. per day. Tyler "C." New pay for 1958 discovery of Tyler oil. Field has 22 producers.

4. Stensvad: McAlester Fuel Corp. 1-A Montana, Rosebud County. IPP 110 BOPD, Tyler "A" pay. New pay for field.

5. Sumatra area: L. L. Tuck et al. 1-B Kincheloe, Rosebud County. IPP 230 bbl. per day. Tyler pay. Extension to Northwest Sumatra field opened in 1952 with Tyler, Amsden, Tyler "A," and Piper Middle Jurassic production. Field has 83 producers.

6. Wildcat: Vaughey & Vaughey 1 Kincheloe, Rosebud County. IPP 145 bbl. per day. Tyler well in Northwest Sumatra area.

OLDER FIELDS

7. Big Wall, 1948: Amsden-Pennsylvanian field in Musselshell County. Also has Tyler pay. Field has 25 producers.

8. Delphia, 1957: Amsden field in Musselshell County. Field has four producers.

9. Melstone, 1948: Tyler sand field in Musselshell County. Field has nine producers.

10. Ragged Point, 1956: Tyler and Kibbey Mississippian field in Musselshell County. Has nine producers.

11. Wolf Springs, 1955: Amsden field in Yellowstone County. Has 18 producers.

Montana gets ready for fast drilling action

MONTANA'S first oil field was discovered at Devil's Basin about 50 miles west of Sumatra in 1919. After 1920 oil hunters moved into the northwestern corner of the state, the south-central Big Horn basin counties, back and forth across the Central Montana uplift, up to the Williston basin, and then back to the central counties again, to the state's oil birthplace. With spring's blessing there will be more than a dozen wildcats engaged in Central Montana exploration in the coming weeks. The objectives for most are the Amsden-Pennsylvanian, Tyler, and Heath-Mississippian rocks. Counties expecting action are Rosebud and Musselshell.

Three Horizons of the Plains

. . . should furnish the explorer with some more fields like Sumatra, Stensvad, and Wolf Springs. The Sumatra area with its Tyler, Amsden, and Jurassic production has grown considerably since 1952. It remains the biggest field on the plains and is the easternmost of a series of fields including Gage, Big Wall, Melstone, Ragged Point, Ivanhoe Dome, and Cat Creek. Very little activity took place in Central Montana after Cat Creek with its 80 producers was opened in 1920 until 1948 with the opening of Big Wall and Melstone.

There were five Amsden and Tyler sand discoveries in the area last year, while one new-pay strike has hit the books already this year. The latest big field opener in the basin was 2 years ago at Stensvad. This 22-well producer has production in Tyler "C," Tyler "A," and Tyler sands. The big story before Stensvad was Wolf Springs in 1955 with its 18 Amsden producers.

Current Plains Outlook

. . . is the brightest in nearly 2 years. The sporadic ups and downs of Central Montana wildcatting may be settling down to a determined, steady, and thorough search of the Lower Pennsylvanian and Mississippian section that has given rise to so many good oil fields. Sinclair Oil & Gas Co. has an Amsden strike 2 miles south of Sumatra town and about 4 miles west of original Sumatra field. This one wildcat should stir drilling in an area of little previous activity. Much of the year's exploration on the plains depends on this well, which flowed 30 bbl. per hour on tests.

John C. McCaslin.

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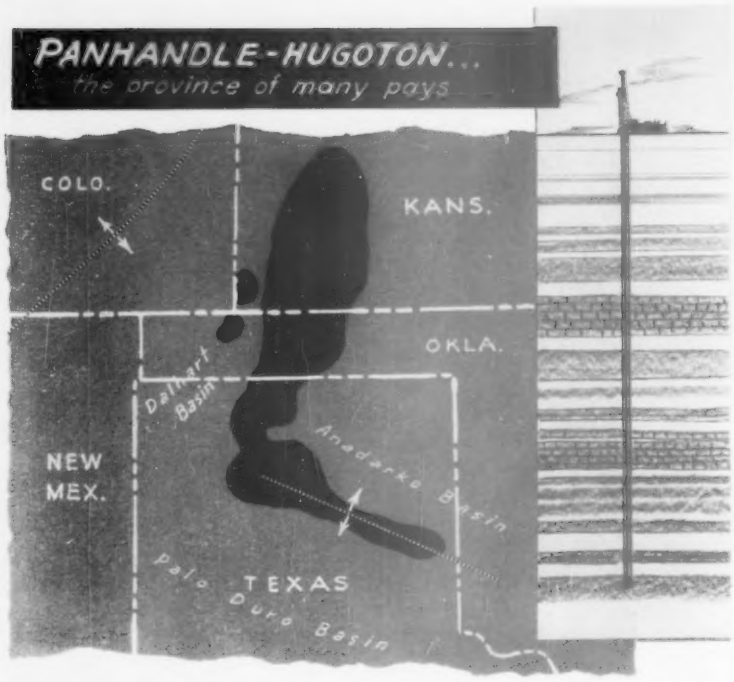

MORE THAN HALF of the fields in the vast Panhandle-Hugoton region have production from more than one sand.

1960's will be Hugoton's decade

KENNETH CHASTEEN
Managing Editor
Dwight's Panhandle Oil Explorer
Amarillo, Tex.

A PORTION of the history of the domestic petroleum industry is being rewritten in the five-state Hugoton-Panhandle area. This portion is the influence of reservoir reserve studies upon the tempo of drilling. A big percentage of the fields encompassed in what is now referred to as the Amarillo-Hugoton area have yet to go under the calculator's pen as to reserves; however, drilling continues at a breakneck pace in the deep zones due to the multitude of pays.

So far, only one reservoir analysis of consequence has been published on a field in this area. During 1959, "Reserves Study of Morrow Sand Light Field" by B. G. Barby, was published in The Oil and Gas Journal. This field, one of the first deep-zone producing areas of Beaver County, Oklahoma, was shown to have excellent reservoir capacity and profit was estimated quite high. Although the article brought pro and con comments from industry representatives in the area, drilling continued. The mentioned article failed to take into consideration the fact that within the continuous production area of Light field, there is also oil production from the Des Moinesan period and from the lower Morrow sand as well as gas production from the lower Morrow and the Mississippian.

This is the case in more than 50% of the fields in the five-state area. Even the old fields, the Texas Panhandle oil and gas and Hugoton gas field, are productive at multiple stages. The Red Cave, Moore County lime, Brown dolomite and Granite Wash produce at one point or another over the huge Texas Panhandle field, while the entire Chase group, as well as the Council Grove can be found in Hugoton gas field of the Oklahoma Panhandle and Southwest Kansas.

Texas

In the deep producing areas of the Hugoton embayment and the Anadarko basin, the multiple-producing prospects appear even more pronounced.

Hansford field of Hansford and Ochiltree County in the Texas Panhandle is one of the most noteworthy examples of multipay production in the area. Its erratic outline at the close of 1959 encompassed 20 separate producing zones, all adjoining and all carrying the Hansford field name. A check of the field as of January 1, 1960, showed 4 Douglas gas wells, 2 Cleveland gas wells, 1 Hepler gas well, 5 Marmaton oil wells, 2 Marmaton gas wells, 2 Oswego gas wells, 1 7,000-ft. Morrow gasser, 181 gas wells from the upper, middle or lower Morrow sands, 2 Mississippian gassers, 21 Tonkawa gas producers, 1 Cleveland oil well, 1 basal Missourian gasser, 19 Cherokee oil wells, 1 Lower Cherokee oil producer, 1 Atoka oiler, 1 Hepler "A" sand oil well and 1 Lower Missouri (Kansas City) gas well. The outline of the described area also includes approximately 20 oil producers which are classified as Horizon Cleveland field and are not in the totals carried above.

Oklahoma

The Texas Panhandle is not alone in this multiblessed position. The Camrick area of Beaver and Texas County, Oklahoma, and the physically, if not officially, combined Mocane-Laverne gas area of Beaver and Harper County, Oklahoma, as well as the Keyes area in Cimarron County, are all productive from more than three horizons.

North Buffalo field of northeastern Harper County is now producing from Lansing, Kansas City, Oswego, Viola and Arbuckle oil, as well as Kansas City, Oswego, Morrow, and Viola gas. This is one of the few fields in the area on which operators have attempted to figure reservoir information and profits. Information available at the Oklahoma Corporation Commission at the end of 1959 shows an estimated 7-year payout at 20 bbl. daily from the Lansing oil zone and a net profit of $203,000 from a reserve of 221,000 bbl. The Kansas City oil zone with one well at the end of 1959 was figured to have 184,000 bbl. oil in reserve for a 5-year payout at 25 bbl. daily and a net profit of $202,000. From the Oswego oil zone, which has one well to date, operators show 46,000 bbl. in reserve for a net profit of $2,000 after a 4-year payout at 30 bbl. daily. The Arbuckle, which had seven wells at the end of 1959, was calculated to have 477,000 bbl. per 40-acre unit and profit was set at $590,000 after a 5½-year payout at 36 bbl. per day. No figures were filed for the Viola oil zone and the gas zones at year's end.

Kansas

The multipay prospect carries over into Southwest Kansas where such fields as Eubank and Greenwood gas area hold sway.

In the combined Eubank area at the end of 1959, there were two Lansing gas producers and one Lansing oil producer. There were two Kansas City oil producers and two Kansas City gas

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The time may well have come when you must start living under the new conditions in the oil business. There's no better way to get started than by beginning to work with the Oil and Gas Loan Department of The National Bank of Commerce.

The oil and gas business is going to be around for a long time to come. Our experience and knowledge of all business can help you to get over the next few years, can help you to keep your organization intact and in good shape. Knowing the oil and gas business is one more reason so many leading independents are with us now. They need the best in banking, and the best in banking costs no more.

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wells. The Marmaton section had one oil and one gas well, while the Cherokee zone boasted one oil well. There were four Morrow oil wells and two gas producers. The most productive formation, the Chester, had a total of 10 oilers and 1 gas well while the St. Genevieve was producing from 3 oil wells. The field also lies in the Hugoton gas area and is productive in that pay over the entire area.

The Greenwood area of Morton County is predominantly a gas-producing area; however, within its continuous-production boundaries are not only its predominant Virgil (Topeka) gas production, but Elkhart lower Morrow gas field, West Elkhart lower Morrow gas distillate field, Taloga lower Morrow oil field, Wilburton lower Morrow gas field, Northeast Taloga Krider gas and lower Morrow oil field, Boehm upper Morrow oil and lower Morrow gas field, Interstate lower Morrow oil and gas field and Ryer Barmaton gas field.

Colorado

Even southeastern Colorado shows the effects of multiproduction. A count of the 11 separate producing areas in Baca, Bent, Kiowa and Prowers County at the beginning of 1960 showed five of them productive from more than one horizon. The combined area has oil production from the Morrow, Atoka, Lansing and the Marmaton. Gas is productive from the Marmaton, Morrow, Cherokee, and the Virgil.

Morrow

Morrow sands are proving to be productive of either oil or gas over almost all of the Amarillo-Hugoton area. In many instances up to nine separate layers of this section can be found. This is common on the southwest edge of the Anadarko basin-Hugoton embayment area in Hansford and Ochiltree County of the Texas Panhandle. On the other hand, the formation is completely missing along the northeastern and northern flanks of the basin as it rises to the Central Kansas uplift.

Mississippian

Mississippian rocks are yet to be fully explored over a big portion of the five-state area. Only on the northern flanks of the combination basin and embayment in Haskell and Finney County, Kansas, has this age received any noteworthy amount of development. Ironically production from this period on the northern part of the area is predominantly oil while in the Texas Panhandle, the Oklahoma Panhandle and northwestern Oklahoma and the more southerly counties of Southwest Kansas, the zone tends toward gas production.

Tonkawa

During 1959, the Tonkawa formation began to show a northwest-southeast trend across a big portion of that part of the Anadarko basin from Hemphill County in the Texas Panhandle north through Beaver County in the Oklahoma Panhandle.

Hunton

Developments thus far in 1960 have opened Hunton gas production for Harper County, Oklahoma, in the east-central part of the Anadarko basin and have opened Wolfcamp (Brown dolomite) gas production on the northeast edge of the Palo Duro basin in Carson County, Texas.

Northwest Oklahoma

The eastern counties of the Anadarko basin are only now coming into their own as producing areas. Woods, Woodward, Dewey, and Major are seeing a daily increase in activity. Although production thus far in the area is in the majority from the Lower Pennsylvanian (Morrow) or the Mississippian period, operators are apparently undaunted by the well costs at these depths and are continuing their play. Recent state land lease sales featuring tracts in these counties have seen fantastic bonuses paid.

In the central part of the Anadarko basin, northern Ellis County is rapidly developing into a major gas-producing area. Development has begun on a total of 18 fields, of which only 3 are oil. Production in the county at the end of 1959 was totally of Pennsylvanian age with the Tonkawa, Morrow, Cottage Grove and the Cleveland sands being represented. The south half of the county as well as all of Roger Mills County remains unproductive.

Dry Areas

Only the Dalhart basin of the northwestern Texas Panhandle and the Raton basin of northeastern New Mexico failed to open new production in the five-state area during the past year.

The astounding wildcat success ratio of more than 50% makes this portion of the United States one of the few showing an increase in activity.

For much of the major producing area of this county, the past year was not only the end of a decade, but of an era. A gradual decrease in activity has set in along with an economy move in many areas. This is not the case in the Amarillo-Hugoton area; 1959 for this vast region was the point-

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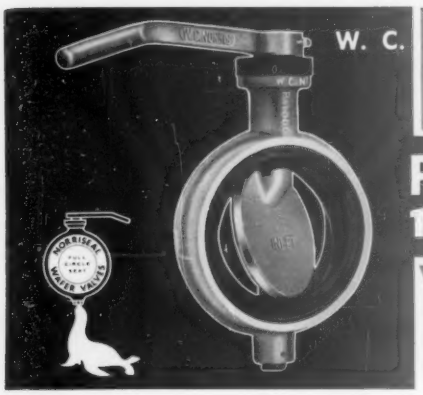

On the drilling barge "TEXAS"

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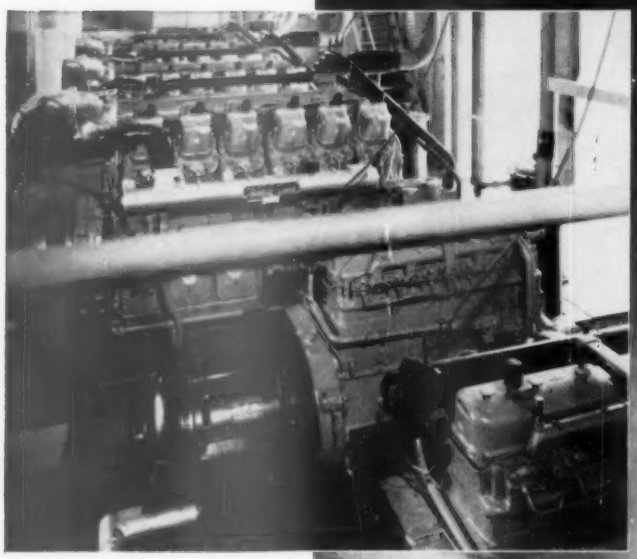

Three Waukesha turbocharged Diesels for drilling and pumping

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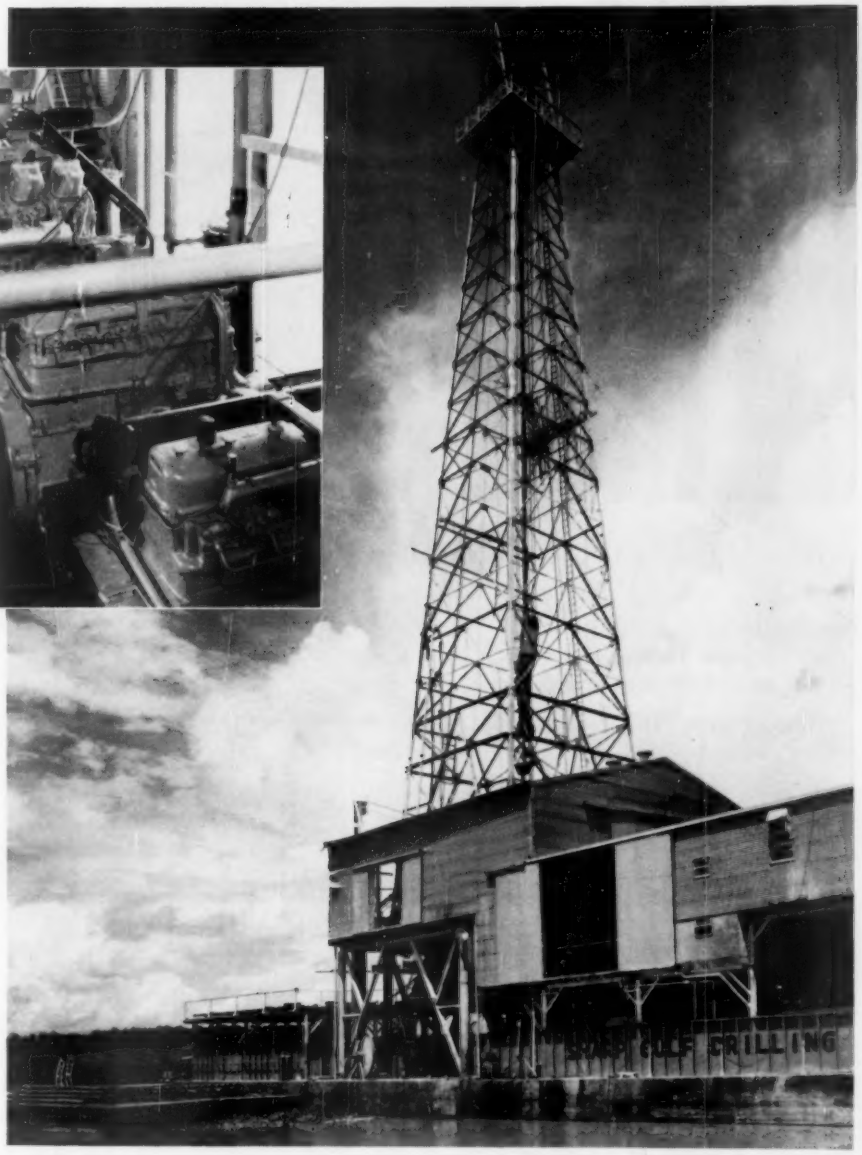
Drilling barge "Texas" is owned by Sharp Gulf Drilling Co., Inc. New Orleans, La.



Drilling at Texas Gulf Producing Co. location near Bourg, Louisiana, the drilling barge "Texas" . . . owned by Sharp Gulf Drilling Co., Inc., New Orleans, Louisiana . . . is all-Waukesha powered. Driving through a Model A295-100-12 National torque converter, three Waukesha Model VLRDBS Turbo-Supercharged Diesels—12-cylinder, 60-degree vee, four-cycle, 8½ x 8½-inch bore and stroke, 5788 cubic inch displacement, with counterbalanced crankshaft—power the Model B3661 Bethlehem drawworks and two 8-inch bore x 16-inch stroke Model B1640 Bethlehem pumps. Two 100 KW Model WAKDU Waukesha Enginators (engine generator sets) supply all electrical requirements. Send for descriptive bulletins 1663 and 1648.

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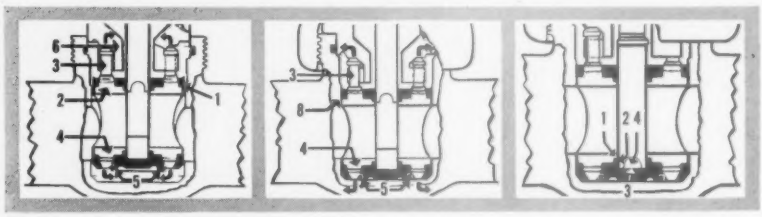

A. Resilient seat assembly (1) is reinforced with steel wear rings (2), having integral projecting pins at top (3) and bottom (4). In normal contracted position, the seat assembly is easily inserted in, removed from the body. Until the seat assembly is bottomed, the steel spread ring (5) does not act upon the lower projecting pins, nor do the bonnet legs (6) act upon the upper pins.

B. With the bonnet down and the seat assembly bottomed, the spread ring (5) has forced the lower projecting pins (4) outward. Similarly, the upper pins (3) have been wedged outward by the descending bonnet legs, providing a tight seal between body wall (8) and seat, preventing entrance of abrasives between seat and body wall.

C. As gate is closed, leading edge of gate slides past wear ring (1), contacts rubber ring (2) for positive rubber-to-metal seal. Seal occurs before gate touches rubber cushion (3), eliminating need for "bumping." Relief in bottom of gate (4) allows straddling of solid particles that might interfere with proper closure.

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er towards, not only increased drilling and producing, but economical and industrial development which is expected to equal or surpass, during the next decade, that enjoyed by the Permian basin in the last.

East Kentucky's deepest hole below 10,000 ft.

In Bell County, eastern Kentucky, east of Pineville, the county seat, the deepest driller in eastern Kentucky is that of United Fuel Gas Co. 1A Knuckles. Currently making hole just below 10,000 ft., the test is scheduled to have a look at the deep-lying Cambrian and Ordovician strata. Well is a short distance from the Pine Mountain fault, a northeast-southwest-trending feature.

More shallow oil found in southern Kentucky

In southern Kentucky's Clinton County shallow play, A. W. Phillips got a discovery at 1 Thrasher, 1,500 ft. from the Clete Garner discovery of last winter. The new well flowed at the rate of about 2 bbl. per minute. The well later clogged up, and then blew out again.

Production is in a break between the Lebanon and Stones River Silurian formations. Two other wells have gone on production near the original Garner discovery. Both are in the 100-bbl. class.

Oil flows at Amsden Montana wildcat

Amsden production is reported at a Central Montana wildcat, Sinclair Oil & Gas Co. 1 Kesterson in C SE NW 34-10n-33e, Rosebud County, 4½ miles west of Sumatra field.

The well flowed 104 bbl. of oil in 7 hours on test of perforations at 4,815-26 ft. Flow was through 3/32-in. choke. Location is 2½ miles south of Sumatra.

New pay opened in Antelope field, North Dakota

North Dakota's Antelope field has a new-pay discovery at Amerada Petroleum Corp. 1-A Antelope Unit in NE SE 1-152n-95w, McKenzie County.

Production was opened in Duperow Devonian and Silurian. The field has Madison and Devonian production (Spanish sand). The well flowed 250 bbl. of oil and 10 bbl. water daily on

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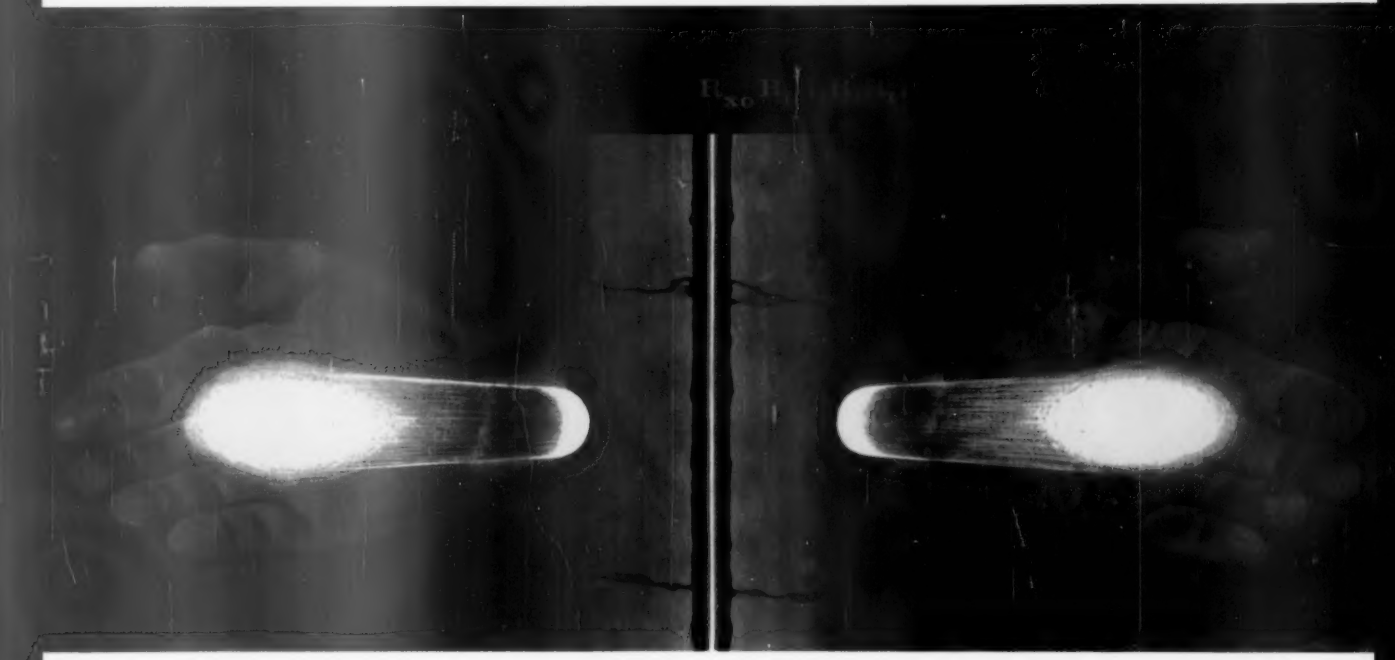

Engineered to overcome deep invasion, the new Schlumberger Deep Induction Log retains all the advantages of the Induction-Electrical Log . . . symmetrical response, thin bed definition, detail for correlation, simultaneous recording with 16″ SN and SP . . . *plus* an investigation twice as deep which gives twice the contrast between water and oil.

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12/64-in. choke from Duperow at 10,728-78 ft. and 79 bbl. of oil and 16 bbl. salt water and acid residue through 20/64-in. choke from Silurian at 11,727-11,826 ft. This well is the deepest in the Williston basin at 15,135 ft. total depth in Cambrian.

Ohio's Fallsburg field grows again

In Ohio another good producer was reported completed in Fallsburg pool. Hoosier Oil & Gas Co., 1,200-ft. stepout, 4 Melvin Ashcraft, Section 12, Fallsburg Township, Licking County, found Clinton sand production at 3,088-3,138 ft. which tested 350 bbl. of oil per day after fracture.

An interesting development in the shallow sands is the seventeenth success in a Cow Run oil play in southeast Lee Township, Monroe County. Vess & Dickson 11 G. & H. Harmon, Section 11, gaged 139 M.c.f.d. from 736 to 746 ft. and had an estimated 100 bbl. of oil per day from 752 to 792 ft.

Buttonwillow gas field extended in California

Gas production in the Buttonwillow field of Kern County was extended more than ½-mile northwest of the nearest producer by Carr and Wrath, operators. The new well, FR-6 Sears-SP Unit, found gas in both the Mya zone and Arlington. The Mya was perforated at 2,581-89 ft. and flowed at a 1,450 M.c.f.d. rate through a 10/64-in. choke. The Arlington was perforated at 3,204-12 ft. for 1,200 M.c.f.d. through a 9/64-in. choke.

New pool for Paloma in California

The Paloma field of Kern County yielded another new pool in a wildcat drilled by Richfield Oil Corp. 2½ miles north of the nearest field producer. Although production figures were not immediately available, the well found the new pool at 10,880-19,950 ft. It was being put on the pump.

Discovery wells

WESTERN CANADA

Alberta:

Mobil-Atlantic 10-19 Swan Hills, LSD 10, 19-67,9w5. Slave Point oil discovery. TD 8,100 ft. Hudson's Bay-Imperial 8-24 Lanaway, LSD 8, 24-36-4w5. Pekisko gas discovery. TD 9,751 ft.

Pan American 5-8 Bigstone, LSD 5, 8-61-22w5. D3 gas discovery. TD 11,353 ft.

Home-C&E 10-25 Westcott, LSD 10, 25-31-3w5. Mississippian gas discovery. TD 8,246 ft.

Three States-Canadian Petroleum 6-29 Oyen, LSD 6, 29-29-4w4. Viking and Detrital gas discovery. TD 3,070 ft.

North Canadian Oils 11-28 Big Stone Lake, LSD 11, 28-26-9w4. Basal Quartz gas discovery. TD 3,399 ft.

Pure-Texas Pacific 4-23 Bingley, LSD 4, 23-40-7w5. Suspended indicated Shunda gas discovery. TD 11,823 ft.

British Columbia:

Sinclair et al. D-18-E Pejay, 18-3-94-A-16. Triassic "D" oil discovery. TD 3,895 ft.

Dome 16-2 Boundary Lake, LSD 16, 2-84-16w6. Triassic oil discovery. TD 4,440 ft.

ILLINOIS

Wayne County:

Jack Inglis Oil Co. 1 Frederick, SW NW NE 17-1n-9e. IP 25 BOPD, Aux Vases 3,161-71 ft. TD 3,293 ft. Opens Mt. Erie pool.

INDIANA

Spencer County:

A. Robertson 1 Joe Schaeffer, NE NW SE 9-5s-4w. IP 10 BOPD, 10 BWPD, Jackson 681-684, 684-695 ft. TD 695 ft. Opens West Fulda pool.

Great Western Drilling Co. 1 Freshley, NW SW NE 36-6s-6w. IP 26 BOPD, Benoist 1,198-1,205 ft. TD 1,205 ft. Opens North Rockhill field.

KANSAS

Butler County:

H. H. Blair 1 Blair North Ranch, C NW NE 26-29s-6e. IP 8 BOPD, 15 BWPD, 35°, Kansas City 2,320-22 ft., 2,326-28 ft. TD 3,313 ft. Opens East Steinhoff field.

Cheyenne County:

J. P. Saffa and Alberta Brauer 1 Weaver, C SE SW 13-4s-38w. IP 192 BOPD, 38°, Marmaton 4,765-70 ft. TD 5,145 ft. New field.

Cowley County:

L. A. Watson 1 Evans, SW SE NE 23-31s-5e. IP 50 BOPD, 40°, Layton 2,282-85 ft. TD 2,350 ft. Opens North Shannon field.

Toco 1 Lowe, C E½ NW NE 3-32-5e. IP 5 BOPW, 5 BWPD, 39°, Layton 2,341-44 ft. TD 2,617 ft. Opens East Elrod field.

Decatur County:

Halliburton Oil Co. et al. 1 Vavroch, SE SE NE 4-4s-28w. IP 140 BOPD, 37°, TD 3,950 ft. Opens Vavroch field.

Edwards County:

Honaker-Davis 1 Parker, C NE NE 29-25s-16w. IP 5 BOPD, 38°, Cherokee 4,352-72 ft. TD 4,477 ft. Opens West Wil field.

Ellis County:

Don Pratt 1 Pratt "B," NW NE NW 28-13s-16w. IP 78 BOPD, 38.5°, Lansing-Kansas City 3,284-86 ft. TD 3,552 ft. Opens West Air Base field.

Geary County:

Adair Oil Co. 1 Green, SE SE SE 27-11s-8e. IP 15 BOPD, 34°, Cherokee sand 1,751-59 ft. TD 1,827 ft. Opens Gee-See field.

Hamilton County:

Hamilton Bros. 1-16 Tate "A," NE NE NE 16-24s-41w. IP 1,024 M.c.f.d., Winfield 2,305-11, 2,315-20 ft. TD 2,430 ft. New field Medway.

Haskell County:

United Producing Co. 2 E. M. Gregg, C NW NE 4-29s-34w. IP 8,185 M.c.f.d. Kansas City 4,476-97 ft.; Morrow 5,185-5,221 ft. TD 5,680 ft. New pay at South Eubank.

United Producing Co. 3 Gregg, C NW NW 4-29s-34w. IP 4,200 M.c.f.d. Lansing 4,084-4,102 ft. TD 5,555 ft. New pay in S. Eubank.

Logan County:

John O. Farmer 1 Rohrs, C NE NW 18-11s-33w. IP 65 BOPD, 37°, Lansing-Kansas City 4,225-29 ft. TD 4,840 ft. Opens Monument field.

Scott County:

Kewanee Oil Co. 1 Wasinger "A," C NW NW 12-20s-33w. IP 70 BOPD, 28°, L. Penn. 4,618-23 ft. TD 4,740 ft. New field.

Seward County:

Republic Natural Gas Co. 1 Stoddard, C SW SE 14-33s-31w. IP 8 BOPD, 33°, Morrow 5,635-40 ft. TD 5,890 ft. New pay at Kismet.

Sumner County:

Mull Drilling Co. 1 Kerley, NE NE NW 1-30s-1w. IP 15 BOPD, 43°, Simpson 3,829-33 ft. TD 3,835 ft. Opens Kerly field.

Walters Drilling Co. 1 Attebery, NW NW SE 20-33s-1w. IP BOPD, 47°, Simpson 4,283-86 ft. TD 4,286 ft. Opens Attebery field.

KENTUCKY

Webster County:

Indiana Farm Bureau 2 Low Moisture Coal Co., 16-L-22. IP 30 BOPD, 20 BWPD, Cypress 2,244-49 ft. TD 2,645 ft. Opens South Lisman field.

NORTH LOUISIANA

Bienville Parish:

Milton Crow, Inc., and Robert P. Evans 1 Whitley, 26-17n-6w, 1⅞ miles southeast of Bryceland. IP 3,200 M.c.f.d., calculated open-flow potential, shut-in TP 3,085 psi., perf. 7,602-10 ft., Travis Peak. TD 8,218 ft. Extends Bear Creek field 1½ miles northwest.

Caddo Parish:

J. M. Harper, Jr., 1-A R. T. Glassell, SW NE SW 10-20n-15w. IP 5,500 M.c.f.d. (calculated open-flow potential), 6.7 BC per M.M.c.f., 63.8°, perf. 4,636-44 ft., basal Sligo. TD 5,230 ft. New pay in Pine Island field.

DeSoto Parish:

Barnwell Drilling Co., Inc., 1 Mrs. Eva Youngblood Walker et al., 20-11n-13w, 1¾ miles south of Trenton. IP 56 M.M.c.f.d., calculated open-flow potential, perf. 2,930-38 ft., Paluxy. TD 3,210 ft. Discovery well South Trenton field.

F. W. Willson 1 Thigpen, 26-11n-13w, 4 miles southeast of Trenton. IP 3,500 M.c.f.d., calculated open-flow potential, perf. 2,796-2,811 ft., Tuscaloosa. TD 3,157 ft. New field.

Tensas Parish:

Pioneer Oil & Gas Co., Inc., Estate of William Helis, and La Grange Petroleum Co. 1 Ellen S. Matthews et al., C NE NE 30-12n-11e. IP 42 BCPD (net), 438 M.c.f.d., 50% b.s. and w., 54°, TP 1,375 psi., perf. 8,381-90 ft., Tuscaloosa. TD 8,465 ft. Extends Justina field ⅜ mile southeast.

SOUTH LOUISIANA

St. Martin Parish:

Shell Oil Co. 2-A Jeanerette, 13-14s-12e. IP 292 BOPD, 8/64-in., 32.9°, GOR 753 cu. ft. per bbl., TP 1,200 psi., perf. 11,427-36 ft., and 162 BOPD, 8/64-in., 34°, GOR 815 cu. ft. per bbl., TP 725 psi., perf. 11,062-67 ft. TD 12,517 ft. Second well and new pays in Belle River field.

NEW MEXICO

San Juan County:

Gulf Oil Corp. 1 Government, NE SE

(Continued on page 182)

▶▶▶ Personals

H. F. Nabors, general manager of Continental Oil Co.'s central region, Oklahoma City, has been promoted to manager of production in Conoco's foreign department, a new position. Nabors currently is attending an advanced management course at Harvard University. He will take over the new job when the course is completed in late May. He will headquarter in New York. Nabors has been with Continental since 1935. He was southern regional production manager in Houston before moving to Oklahoma City in 1955 as assistant general manager of the central region. He was promoted to regional general manager in 1957.

O. P. Thomas, vice president of Sinclair Oil Corp. since 1957, has been named executive vice president and a director of the company. As executive vice president, he succeeds **Harry Jeffries,** who has retired from this post. Jeffries will continue as a director and chairman of the finance committee.

Verner Jones, exploration manager in the corporate exploration and producing department of Socony Mobil Oil Co., Inc., has been given a 1-year assignment as exploration manager for Mobil Oil of Canada, Ltd., (Libyan branch) in Tripoli, Libya. He succeeds **Roland W. Garwood,** who has been transferred to Mobil Oil de Venezuela. Jones will return to his present post with Socony in a year.

Wayne R. Ranta, Sinclair Oil & Gas Co., has been named president of the Society of Professional Well Log Analysts, Tulsa chapter. He succeeds **Don Butler,** Phillips Petroleum Co., who has been given an overseas assignment. **J. E. Carothers,** Phillips, has succeeded Ranta as vice president of the group.

P. B. Hinyard, division exploration manager in Corpus Christi, Tex., for Shell Oil Co., has been named Houston area geologist. **D. H. Bredeson,** production geologist in the New Orleans area, has been transferred to Houston, and **R. N. Ginsburg,** geologist, has been named senior geologist, Houston. Also, **D. R. Droemer,** mechanical engineer, has been appointed development engineer, Houston.

Donald D. Davidson, manager of manufacturing for Golden Bear Oil Co., has been elected vice president in charge of manufacturing operations.

Walter P. Krause has been named supervisor of the plant and sales technical service section at Jefferson Chemical Co.'s Austin, Tex., laboratories.

Lewis McGuire, division production superintendent for Continental Oil Co., has been transferred to Billings, Mont., from Cody, Wyo.

Wesley B. Cooper, Washington district manager for Esso Standard Division of Humble Oil & Refining Co., has been named sales and operations manager of Humble's new Ohio division.

Will Frank, general superintendent of Austral Oil Co., Inc., has been elected vice president in charge of the drilling and production department. Frank had been with Phillips Petroleum Co. and Progress Petroleum Co. before joining Austral in 1956.

Harold Bottomley, consultant to Vitro Engineering Co.'s Treco Division, has joined Vitro as regional manager in charge of the Treco Division. He will be responsible for all operations in the Tulsa office. The appointment will eliminate the position of president of Treco. **Woodman Perine,** who has held this post, continues as vice president of Vitro Corp. of America in charge of the technical services and products group, which includes Vitro Engineering Co. Bottomley was a vice president of the Refinery Engineering Co., predecessor of Treco, before he became a consultant in 1953.

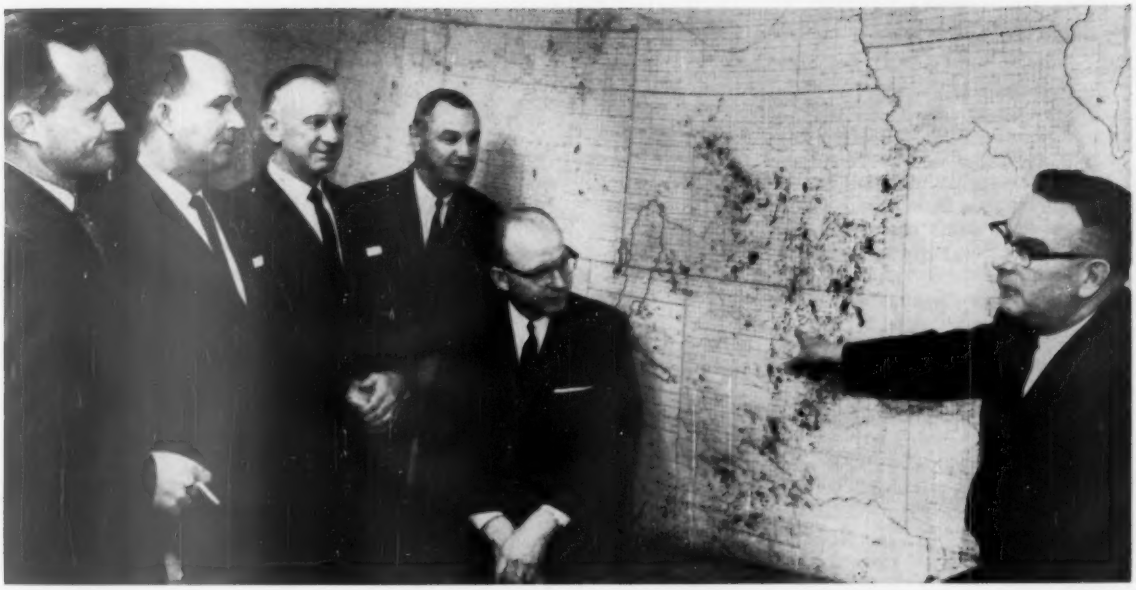
C. F. McCoy, vice president and administrative coordinator for Sinclair Oil & Gas Co., has been elected a director of the company. McCoy was vice president and a director of Sinclair Pipe Line Co. before joining Sinclair Oil & Gas last year. **William J. Robinson,** staff geophysicist for Sinclair Oil & Gas in Tulsa, has been named division geophysicist in Denver. He has been with the company since 1941. **Leslie M. Sellers,** assistant district production superintendent in Monahans, Tex., has been promoted to district superintendent and transferred to Silsbee, Tex. He succeeds **H. H. Morgan,** who has retired. **C. G. Confer,** assistant district superintendent in Hobbs, N. M., will succeed Sellers in Monahans. Sellers joined Sinclair in 1950. He was assistant district superintendent in Hobbs before moving to Monahans earlier this year. Confer has been with the company since 1951. In Tulsa headquarters, part-interest section of the production department has been changed to full departmental status. **J. H. Rankin,** superintendent, continues as department head.

McCOY

John D. Moody, exploration coordinator for Gulf Oil Corp. in Pittsburgh, has joined Plymouth Oil Co. as manager of exploration. He will be in charge of the geological, geophysical, and land departments. Moody had been with Gulf for 20 years. He will headquarter in Sinton, Tex.

George Louis, assistant superintendent of the Los Angeles refinery of Texaco Inc., has been named superintendent of Texaco's El Paso, Tex., refinery. **Herbert C. Tenny,** area supervisor of the Los Angeles refinery, has been transferred to Eagle Point, N. J., as supervisor of operations at the refinery there. **George Patterson,** assistant superintendent of Texaco's Port Arthur, Tex., refinery, will succeed Louis in Los Angeles.

M. D. Mauck, division exploration manager in Fort Worth for Pure Oil Co., has been named manager of exploration in the new southern producing division. **L. L. McDonald,** assistant manager of the Texas producing division in Fort Worth, has been appointed southern producing division manager of operations. **Jack W. Boothe,** formerly with Woodley Petroleum Co. and Woodley Canadian Oil Co., will be division manager of services. **D. M. Davis,** offshore coordinator for Pure's Gulf Coast division, will head an exploitation group in the new division. This group will be responsible for special economic and technical studies. **C. C. Brown, W. F. Schafer,** and **D. L. Proctor** have been named area superintendents in the division's operations section. Brown has been assistant to the division manager of operations, Gulf Coast division. Schafer has been Texas producing division production superintendent. Proctor has been district superintendent of the Van Joint Account.



MANAGEMENT changes in Kewanee Oil Co. involve, left to right, Stanley D. Smith, Vance K. Sharpe, J. M. Harbison, T. G. Costakis, J. K. Wetherill, and H. J. McNally.

Kewanee Forms New Management Committee

A NEW management coordinating committee has been set up by Kewanee Oil Co. to act as liaison between the parent company and its subsidiaries, Canadian Kewanee, Ltd., and Kewanee Interamerican Oil Co.

The group will be headed initially by J. K. Wetherill, formerly manager of exploration; J. M. Harbison, formerly production superintendent; and H. J. McNally, formerly general superintendent. As a result of these assignments, several operating personnel changes have been made. Vance K. Sharpe, assistant production superintendent, has been named production superintendent, succeeding Harbison. Tommy G. Costakis, chief landman, has been appointed manager of exploration, succeeding Wetherill. Stanley D. Smith, district geologist, has been named chief geologist, a new position.

The new coordinating committee will be responsible for investigation and appraisal of acreage plays, new developments in technology, new investments, and property purchases. The group will deal with domestic and foreign operations and will work closely with the company's financial and executive committees. Membership in the new committee may be expanded later.

Robert W. Schiessler has been named manager of the central research division for Socony Mobil Oil Co., Inc.

Roy Bennett, Oklahoma City consultant, has received the Silver Anniversary certificate of Society of Exploration Geophysicists. The award recognizes Bennett's continuing activity in the group. Bennett is former chief geophysicist for Sohio Petroleum Co.

John F. Merriam, president of Northern Natural Gas Co., has been elected chairman. He will continue as president. **Max A. Miller,** a director of Northern for 17 years, has been named vice chairman of the board. Merriam has been president of Northern since 1950 and a director since 1946.

D. F. Skaggs, pipeline supervisor with Pacific Northwest Pipeline Corp. in Pocatello, Idaho, has joined Ford, Bacon & Davis, Inc., as supervisor of the land department in Waco, Tex.

Robert T. Kraft, formerly with Tennessee Gas Transmission Co. in Oklahoma City, has joined Union Carbide Corp.'s purchasing department, petroleum division. He will specialize in natural-gas procurement for all Union Carbide divisions.

H. H. (Pat) Everett, division gas coordinator for Sunray Mid-Continent Oil Co., has joined Sadler Brothers Pipe Line Construction Co., Oklahoma City. He will be in charge of gas-gathering line construction.

Ralph S. Nabors has been named to succeed **E. Howard Fisher** as general superintendent of pipeline operations for Pacific Gas & Electric Co. Fisher was recently named vice president in charge of gas operations for the company. Nabors has been superintendent of PG&E's big-inch natural-gas system from the Arizona-California border to San Francisco. **Harry P. Prudhomme** will take over this job as superintendent of transmission and compression. Prudhomme will be succeeded as superintendent of northern division pipeline operations by **Robert W. Brooks,** San Francisco. **Richard I. Stark,** senior transmission engineer in Rosedale, Calif., will succeed Brooks in San Francisco. **Robert J. Knebel** will succeed Stark.

E. D. Brockett, executive vice president of Gulf Oil Corp., and **I. G. Davis,** Gulf senior vice president, have been elected directors of Warren Petroleum International Corp. Warren International, a Gulf subsidiary, specializes in international marketing of liquefied petroleum gas.

Dr. Robert W. Taft, Jr., Pennsylvania State University professor, will receive American Chemical Society's petroleum chemistry award at the society's national meeting next month. Taft will be cited for outstanding contributions to petroleum technology and for application of general organic concepts to this field.

Personals

A. C. Polk, vice president and general manager of Dowell Division of Dow Chemical Co., has been appointed executive vice president and general manager of the division. He succeeds **John G. Staudt** as executive vice president. Staudt has been named president of Dow's Dobeckmun Co. Division in Cleveland. Staudt succeeds **Thomas F. Dolan,** founder of the Dobeckmun Co. Dolan will continue as chairman of the Dobeckmun executive committee. Polk joined Dowell in 1941. He was elected a director of the company in 1950, was named general manager in 1951, and vice president in 1952. He is also vice president and a director of the Dowell Division of Dow International, Ltd., S.A., vice president and committee member of Dowell Division of Dow Quimica Argentina, S.A., and a director of Dowell of Canada, Ltd. Staudt has been with Dowell since 1932 and has been executive vice president and a director of the company for 12 years. He is president and a director of Dowell of Canada and Dowell Industrial Service Division. He is president and committee member of the Dowell divisions of Dow Quimica Argentina and Dow International.

POLK

STAUDT

New directors of Western Petroleum Refiners Association are **R. D. Bent,** Atlantic Refining Co., Philadelphia; **J. C. Ducommun,** Standard Oil Co. (Ind.), Chicago; **H. D. Moore,** Derby Refining Co., Wichita; and **James Van Pelt,** Berry Refining Co., Chicago.

Stewart Cronin, exploration manager for Pure Oil Co., has been transferred from Chicago to Calgary, where he will be in charge of Pure's activities in Canada and Alaska. **Fred A. Devin,** of the Rocky Mountain producing division, has been named exploration manager in Chicago. **Chester M. Harden,** drilling and production superintendent for the Pure-Signal-Sohio group in Venezuela, has been named manager of production for Pure. He will headquarter in Chicago. **James R. McChesney** will continue as manager of the gas department and **Floyd L. Stewart** will continue as chief production engineer. In exploration, **John H. Maher** is chief stratigrapher and **Lee Davis** is chief geophysicist. **Joseph P. LaCroix,** assistant to the vice president for production, has been appointed manager of services. **Raymond H. Rantala** has been named manager of exploitation with responsibility for evaluation studies of production and reserves. **Karl A. Mygdal,** geologist representative in Calgary, has been transferred to Pure's new northern division headquarters in Denver.

H. D. (Ike) Moore has resigned as vice president and executive assistant to the president of Sinclair Oil Corp. in New York to join Derby Refining Co. as president. Moore succeeds **J. W. Meehan,** who recently left Derby to become president of Vickers Refining Co., subsidiary of Vickers Petroleum Co. Moore was with Wood River Oil & Refining Co. and the W. T. Waggoner oil interests before joining Sinclair. He has been a director of Richfield Oil Corp., Great Northern Oil Co., Minnesota Pipe Line Co., Great Northern Oil Purchasing Co., South Saskatchewan Pipe Line Co., and Sinclair & BP Sales, Inc. Moore will headquarter in Wichita.

MOORE

A. E. Meissner, assistant Corpus Christi, Tex., district manager for Sunray Mid-Continent Oil Co., has been named district manager of production in Corpus Christi. He succeeds **Carl E. Wilson,** who recently retired.

George H. Clark, assistant to the general manager, domestic producing department, for Texaco Inc. in Houston, has taken early retirement after 30 years with the company. Clark had been district geologist, division geologist, and assistant division manager in charge of exploration for Texaco before his appointment last year as assistant to the general manager.

Refiners Again Tap Carthaus as WPRA President

W. J. CARTHAUS, right, president of Great Northern Oil Co., was reelected president of the Western Petroleum Refiners Association at the group's annual meeting last week in San Antonio. Carthaus is shown with speakers in the WPRA fuels session. They are, left to right, Max M. Roensch, General Motors Corp., Detroit; E. A. Droegemuller, Pratt & Whitney, East Hartford, Conn.; Bruno R. Siegel, Sinclair Research Laboratories, Harvey, Ill.; L. W. Robbie, Texas City Refining Co., Texas City, session chairman; and Carthaus.

Monsanto Elects New President, Chairman

NEW officers of Monsanto Chemical Co. are Charles H. Sommer, left, president; and Charles Allen Thomas, center, chairman. Edgar M. Queeny, right, chairman since 1943, will continue as chairman of the finance committee, a director, and member of the executive committee. Sommer, executive vice president of Monsanto since last year, has also been elected chairman of the executive committee and a member of the finance committee. Thomas had been president of the company since 1951. He is a member of the executive and finance committees.

John F. Shea, middle Atlantic field supervisor in Tidewater Oil Co.'s eastern division, has been promoted to southern district engineer.

Jack Brand, engineer with Sohio Petroleum Co., has been transferred to Okmulgee, Okla., from Pauls Valley, Okla.

C. W. Bates, H. T. Campbell, and **C. T. Jones** have been promoted to senior supervising engineers in the technical division of Humble Oil & Refining Co.'s Baytown, Tex., refinery.

Richard F. Stringer has been promoted to section head, fuels research and development, at the Baton Rouge, La., laboratories of Esso Standard Division of Humble Oil & Refining Co.

C. Gordon Biggar, manager of Shell Oil Co.'s public relations department, has been named vice president in charge of public relations. He succeeds **H. L. Curtis,** who has retired. Curtis had been a vice president since 1955.

John Keselik, production superintendent at Dow Chemical Co.'s Peverly, Mo., plastic foam plant, has been promoted to manager of the plant. He succeeds **Robert E. Reinker,** who recently was named assistant to the operations vice president of Dow Chemical International, Ltd., S.A.

J. S. Detweiler has been appointed oils planning division manager in the manufacturing department of Standard Oil Co. of California, Western Operations, Inc. He succeeds **F. R. Marshall,** who has retired after 40 years with the company.

▶▶▶ Personals

J. G. McIntyre, Regina, has been named president of Wintershall Oil of Canada, new subsidiary of Wintershall, A. G. **James S. Palmer,** Calgary, will be vice president and secretary. Headquarters of the new company are in Calgary.

O. E. Van Meter, Jr., has been named division engineer for Mobil Oil Co.'s Los Angeles exploration and producing division. In other Los Angeles division appointments, **M. W. Kibre** has been named natural gas manager; **B. H. Robinson,** operations superintendent; **D. G. Kingman,** joint interest manager; **Joseph Neely,** division geologist; **W. P. Carver,** division landman; and **Klaas van der Weg,** division geophysicist. Staff appointments include **R. P. Lavenant, Jr.,** senior attorney; **E. R. Paul,** employe relations manager; and **J. O. Hills,** division comptroller. **Leonard C. Stevens** was named vice president of the Los Angeles division earlier this year. **R. O. Swayze,** division producing manager, and **H. D. Hobson,** division exploration manager, also were appointed earlier. Superintendents of three producing districts within the division are **J. J. Oliphant,** San Joaquin Valley; **H. H. Carrick, Jr.,** Coastal; and **P. M. Barry,** Rocky Mountain. Exploration superintendents are **E. R. Orwig,** Coastal; **C. L. Doyle,** San Joaquin Valley; and **T. E. Hobbs,** Rocky Mountain. In the new Durango, Colo., Rocky Mountain district office, **E. A. Rosenquist, Jr.,** has been named production engineer; **M. C. Kinnon,** production geologist; and **R. E. Yarter,** junior production geologist. They were formerly in Los Angeles. **R. L. Beatie,** junior geologist, has been transferred to Durango from Sacramento, Calif.

▶▶▶ Deaths

Harold L. Sullivan, 62, retired general manager of Loffland Brothers Drilling Co., died March 30 in a Tulsa hospital. He had suffered a heart attack earlier in the week. Sullivan was with Pulaski Oil Co. before joining Loffland in 1921. He retired in 1947.

John B. Bradford, 79, retired Kansas oil man, died March 27 in Leawood, Kans. Bradford was a pioneer in Kansas oil developments. He founded Elrod Oil Co. in 1912 and developed the Elrod, Sedan, and Oxford fields near Winfield. Later, he bought Western Lubricating & Refining Co. The firm was sold when Bradford retired in 1932.

George W. Chapman, 56, manager of Sun Oil Co.'s mid-continent production division, died March 28 in a Tulsa hospital. Chapman had been with Barnsdall Oil Co. and Thomas & Manning Drillers before joining Sun in 1930. He had been Dallas land department manager and acting division manager of the Rocky Mountain division in Denver before being named mid-continent manager in 1957.

▶▶▶ Statistical Section

Beware stock changes in March

BY JOHN C. CASPER

YOU CAN'T COMPARE current operations with records for last year and draw sound conclusions about production, stock, or demand changes. Last year may have been abnormal. If it was, it should not be used as a base for measuring performance for the current year.

For example, we tend to blame the warm weather in December for most of the ills that have beset the industry this winter. Domestic demand for total petroleum products was down in December compared with December 1958. The decrease amounted to 17,500,000 bbl. or 5.0%. However, domestic demand for the month was up 14% from the 5-year average for the period 1953-57.

On the other side of the picture, there is a tendency to compare current major-product stocks with records for March last year and give the credit to the cold weather of the past 6 weeks.

As an example, four-product inventories on February 12 represented a gain of 35,020,000 bbl. over the previous year. Weekly reports showed near-normal stock decreases through the week ended March 4. At that time, four-product stocks represented an increase of 23,700,000 bbl. over total for corresponding date in 1959.

Big changes this year came in March. Four-product stocks for March 25 showed a decrease over last year of 1,476,000 bbl. This big shift from a surplus of 23,700,000 bbl. to a deficit of 1,476,000 bbl. can't be credited entirely to cold weather and high demand this month. Part of the shift must be charged to poor performance during March 1959.

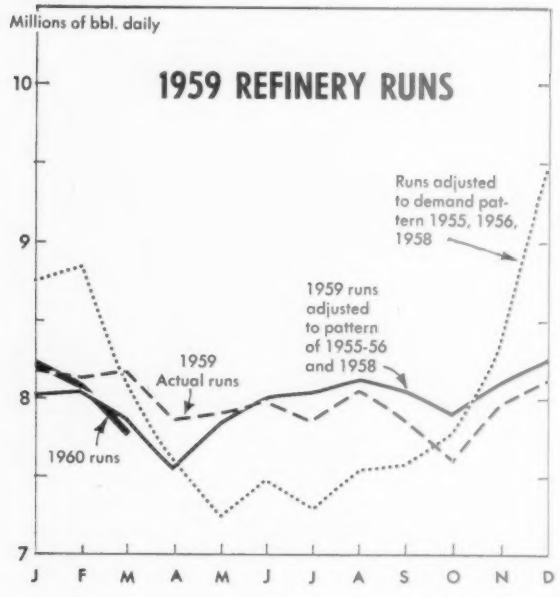
Here is a picture of poor stock management at this time last year. Four-product stocks gained 6,800,000 bbl. in March 1959. A normal stock change for the month called for a reduction of about 9,000,000 bbl. which means that the stock shift for the month was abnormal by almost 16,000,000 bbl.

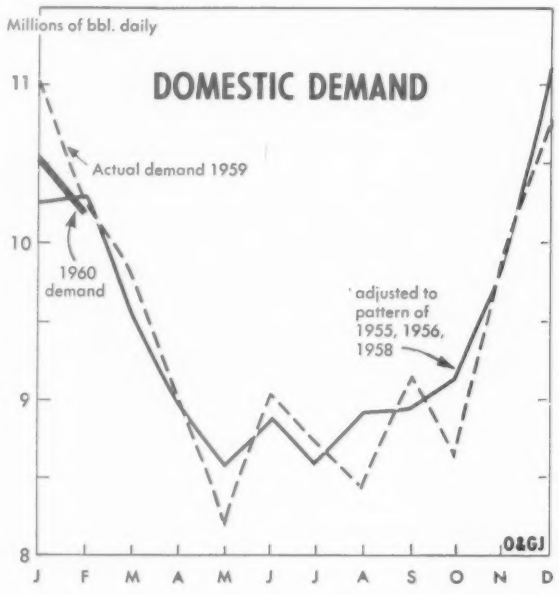
Most of the poor stock performance for March 1959 can be charged against refinery operations. Note on the first chart that actual refinery runs increased from February to March. A decrease of 200,000 bbl. daily would have been normal. The second chart shows that March's portion of total demand for the year was slightly above normal. Don't blame demand.

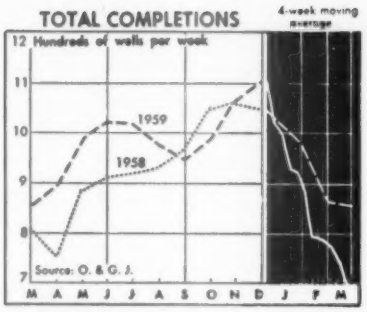
There should be another big change in the spread between current and last year's stocks for week ending April 1. Four-product stocks increased 6,000,000 bbl. during the corresponding week last year. The stock change for the last week of March can be poor and still make a good showing against that record.

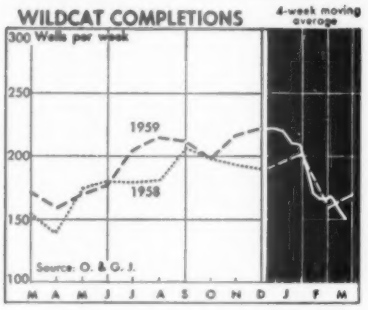
A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,121,710	DOWN	39,034	DOWN	74,780
Crude stocks	255,866,000	UP	1,632,000	UP	1,124,000
Completions	624	DOWN	117	DOWN	223
Refinery runs	7,945,000	UP	88,000	DOWN	62,000
Gasoline stocks	225,987,000	UP	1,523,000	UP	13,033,000
Kerosine stocks	18,099,000	DOWN	685,000	UP	216,000
Distillate stocks	78,012,000	DOWN	4,430,000	UP	1,340,000
Residual stocks	39,852,000	DOWN	1,139,000	DOWN	16,065,000
Four-product stocks	361,950,000	DOWN	4,731,000	DOWN	1,476,000
Total imports	1,589,500	DOWN	366,800	DOWN	195,800


Millions of bbl. daily
1959 REFINERY RUNS
10
9
8
7
Runs adjusted to demand pattern 1955, 1956, 1958
1959 runs adjusted to pattern of 1955-56 and 1958
1959 Actual runs
1960 runs
J F M A M J J A S O N D







Active Rotary Rigs

	3-28-60	3-21-60	3-30-59
Alabama	4	5	7
Arkansas	12	11	14
Arizona	4	2	1
California	85	82	94
Land	83	80	92
Offshore	2	2	2
Colorado	20	23	32
Florida	2	2	3
Land	1	1	2
Offshore	1	1	1
Illinois	15	18	26
Indiana	4	3	7
Iowa	0	0	3
Kansas	77	86	132
Kentucky	4	4	8
Louisiana	296	302	322
North	28	26	32
S. Inland waters	131	130	143
S. Land	89	93	108
Offshore	48	53	39
Maryland	0	0	1
Michigan	34	37	18
Mississippi	59	69	67
Missouri	1	0	0
Montana	12	16	20
Nebraska	22	25	25
Nevada	0	0	0
New Mexico	102	80	102
New York	2	2	0
North Dakota	18	19	43
Ohio	4	4	0
Oklahoma	195	176	213
Oregon	0	0	0
Pennsylvania	11	7	11
South Dakota	2	1	1
Texas	610	622	761
S. Inland waters	7	9	13
S. Land	171	167	170
Offshore	2	2	1
North	41	42	151
Panhandle	60	55	(*)
East	53	42	(*)
West Central	183	205	267
West	93	100	159
Utah	28	30	33
Washington	0	0	0
West Virginia	5	5	5
Wyoming	51	52	48
Total U. S.	1,679	1,683	1,997
Western Canada	180	217	172
Eastern Canada	2	3	0
Grand total	1,861	1,903	2,169

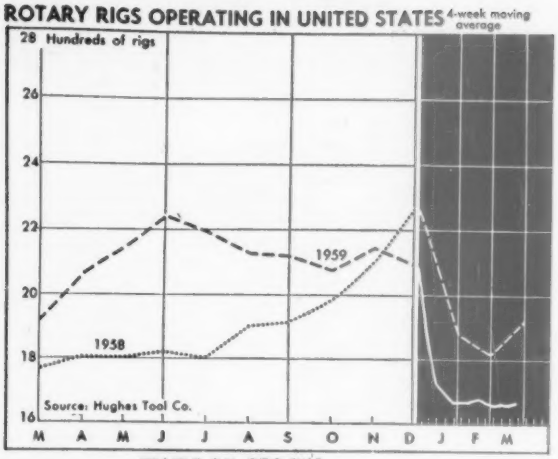
Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 26, 1960

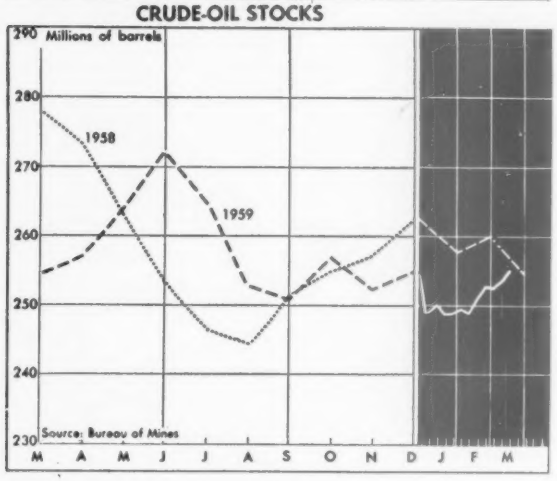
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	14	29	0	0	0	0	0	1	5
Arizona	0	0	0	0	0	0	0	6	.....	0	0	0	0	0	6	.....
Arkansas	7	3	0	2	2	0	33,467	134	222	0	0	0	0	0	34	36
California	25	19	0	1	4	1	122,455	309	373	4	1	0	0	3	70	91
Colorado	12	1	0	0	11	0	61,964	168	179	5	0	0	0	5	76	104
Illinois	10	0	0	0	10	0	17,310	523	521	10	0	0	0	10	146	87
Indiana	5	0	0	0	5	0	5,263	205	159	4	0	0	0	4	85	53
Kansas	52	27	0	2	22	1	185,344	767	959	16	2	0	0	14	245	215
Kentucky	6	0	0	4	2	0	17,272	466	406	1	0	0	0	1	55	47
Louisiana	56	27	4	4	21	0	438,041	764	863	4	0	0	1	3	103	115
North	23	11	0	4	8	0	91,662	246	309	3	0	0	1	2	44	53
South	20	9	3	0	8	0	201,506	384	462	1	0	0	0	1	53	59
Offshore	13	7	1	0	5	0	144,873	134	92	0	0	0	0	0	6	3
Michigan	14	8	0	0	3	3	37,881	175	133	2	0	0	0	2	55	42
Mississippi	23	9	2	0	12	0	214,224	192	152	5	0	0	0	5	66	70
Montana	3	1	0	0	2	0	15,724	59	65	2	0	0	0	2	30	28
Nebraska	9	3	0	0	6	0	53,439	171	176	5	1	0	0	4	71	80
New Mexico	30	20	1	4	5	0	121,747	448	410	5	0	0	0	5	63	41
West	10	5	1	4	0	0	51,101	148	.....	0	0	0	0	0	13	.....
East	20	15	0	0	5	0	70,646	300	.....	5	0	0	0	5	50	.....
New York	0	0	0	0	0	0	0	72	74	0	0	0	0	0	5	4
North Dakota	10	8	0	0	2	0	71,646	75	106	1	1	0	0	0	12	27
Ohio	13	5	0	4	4	0	37,518	265	213	0	0	0	0	0	13	5
Oklahoma	60	33	2	3	22	0	313,716	877	1,406	14	3	1	2	8	173	224
Pennsylvania	0	0	0	0	0	0	0	128	114	0	0	0	0	0	6	3
South Dakota	1	1	0	0	0	0	8,609	11	.....	0	0	0	0	0	4	.....
Texas	258	126	14	7	106	5	996,356	3,747	4,484	54	2	0	0	52	762	882
Dist. 1	9	4	1	0	4	0	25,823	259	289	4	0	0	0	4	90	75
Dist. 2	10	3	2	0	5	0	84,686	157	177	4	0	0	0	4	42	55
Dist. 3	18	8	1	2	7	0	116,151	293	246	4	0	0	0	4	58	69
Dist. 4	17	6	7	1	3	0	84,969	288	289	4	1	0	0	3	86	83
East	18	11	1	0	6	0	86,053	283	271	2	0	0	0	2	58	63
Dist. 7-B	64	26	0	3	34	1	159,521	540	578	19	0	0	0	19	154	163
West	44	32	2	0	9	1	276,497	978	1,422	5	1	0	0	4	150	167
Dist. 9	64	28	0	0	33	3	111,836	699	875	10	0	0	0	10	102	174
Dist. 10	14	8	0	1	5	0	50,820	250	337	2	0	0	0	2	22	33
Utah	5	2	0	0	3	0	22,891	65	91	0	0	0	0	0	22	24
West Virginia	9	0	0	9	0	0	22,797	200	173	0	0	0	0	0	1	6
Wyoming	14	6	0	1	7	0	72,259	231	212	6	1	0	0	5	95	76
Misc. (Alaska, Nev.)	2	1	0	0	1	0	16,914	12	16	1	0	0	0	1	10	13
Total U. S.	624	300	23	41	250	10	2,886,837	10,084	11,536	139	11	1	3	124	2,209	2,278
Previous week	741	350	25	71	272	23	3,404,535	.....	.....	141	12	1	4	124	.....	.....
Cum. 1960	10,084	4,714	331	882	3,855	302	44,067,271	.....	.....	2,209	200	21	65	1,923	.....	.....
Cum. 1959	11,536	5,795	293	801	4,336	311	48,814,359	.....	.....	2,278	245	31	76	1,926	.....	.....
Western Canada	57	30	0	6	20	1	301,528	595	587	23	2	0	5	16	178	225

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	3-19-60	3-12-60	3-21-59
Pennsylvania	2,149	2,179	2,509
Other Appalachian	1,947	1,920	1,493
Illinois, Indiana, Michigan	9,316	9,254	8,485
Nebraska and North Dakota	2,653	2,436	2,144
Kansas	9,241	9,164	8,522
Oklahoma	16,395	17,051	16,435
Arkansas	1,929	2,023	1,819
Louisiana	18,970	19,317	17,922
North	3,150	3,180	3,220
South	15,820	16,137	14,702
Mississippi, Alabama, Florida	2,995	2,765	2,631
New Mexico	7,675	7,933	8,100
Texas	111,574	109,788	110,945
East Texas	8,507	8,206	9,251
West Texas	50,435	50,691	54,818
Texas Gulf	20,149	19,572	17,794
Other Texas	32,483	31,319	29,082
Wyoming	17,234	16,876	13,834
Other Rocky Mountain	9,686	9,584	9,404
California	29,461	29,768	35,160
Foreign	†14,641	14,176	15,339
Total	**255,866**	254,234	254,742

*Bureau of Mines. †Includes 4,387,000 bbl. in California.

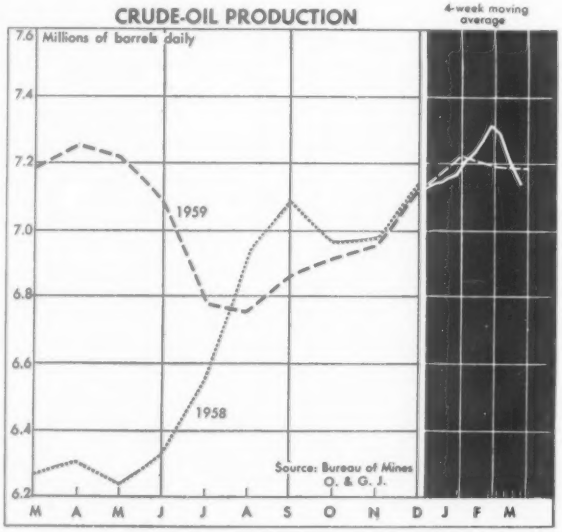
DAILY AVERAGE PRODUCTION FOR WEEK

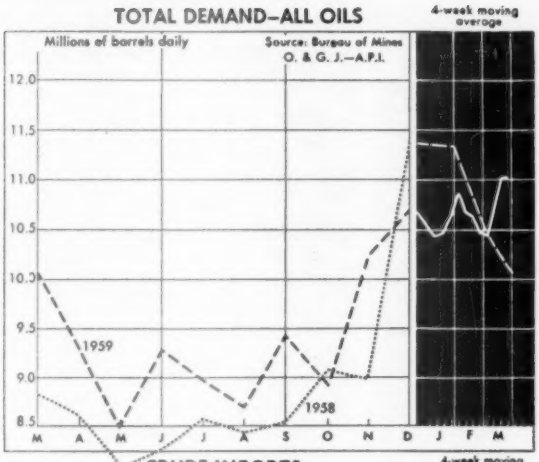
	March 26, 1960			Mar. 19
	Crude oil	Lease condensate	Total	total
Alabama	19,400	.....	19,400	19,375
Arkansas	82,350	150	82,500	83,275
California	827,500	.....	827,500	830,100
Colorado	128,300	.....	128,300	130,100
Eastern	39,500	.....	39,500	36,800
Florida	1,200	.....	1,200	1,200
Illinois	217,300	.....	217,300	215,300
Indiana	32,700	.....	32,700	32,900
Kansas	†270,360	.....	†270,360	†309,844
Kentucky	62,000	.....	62,000	66,400
Louisiana	962,750	133,500	1,096,250	1,097,400
North	107,750	6,000	113,750	114,900
South	855,000	127,500	982,500	982,500
Michigan	31,800	.....	31,800	31,600
Mississippi	134,100	4,225	138,325	138,325
Montana	80,500	.....	80,500	80,900
Nebraska	60,500	.....	60,500	62,300
Nevada	100	.....	100	100
New Mexico	306,600	8,500	315,100	315,100
North Dakota	51,400	.....	51,400	50,100
Oklahoma	†548,500	.....	†548,500	†533,550
Texas	2,583,000	91,625	2,674,625	2,674,625
Dist. 1	41,000	3,500	44,500	44,500
Dist. 2	114,000	9,100	123,100	123,100
Dist. 3	325,000	38,000	363,000	363,000
Dist. 4	190,000	17,000	207,000	207,000
Dist. 5	29,000	500	29,500	29,500
Dist. 6	114,000	10,000	124,000	124,000
East Texas field	139,000	.....	139,000	139,000
Dist. 7-B	137,000	300	137,300	137,300
Dist. 7-C	127,000	3,525	130,525	130,525
Dist. 8	1,067,000	6,000	1,073,000	1,073,000
Dist. 9	192,000	2,400	194,400	194,400
Dist. 10	108,000	1,300	109,300	109,300
Utah	111,500	.....	111,500	110,100
Wyoming	331,000	.....	331,000	340,000
Others	‡1,350	.....	‡1,350	‡1,350
Total U. S.	6,883,710	238,000	**7,121,710**	7,160,744
Change from prev. week, down			**39,034**	.....
Canada	†593,100	.....	†593,100	†597,500

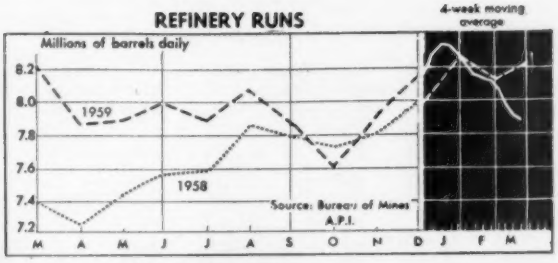
Total U. S. prod., Jan. 1-Mar. 26 ..... 619,964,570 bbl.
Same period last year (crude plus cond.) ..... *612,387,100 bbl.

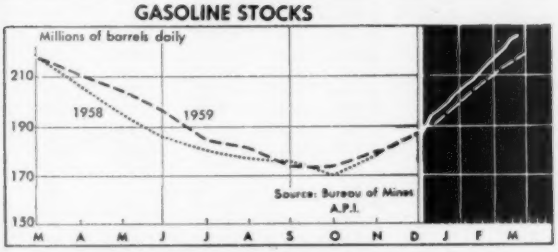
*Includes 16,727,700 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

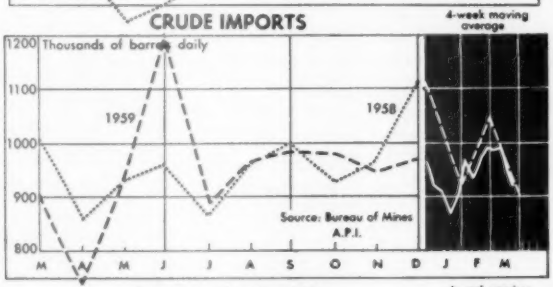
CRUDE-OIL PRODUCTION

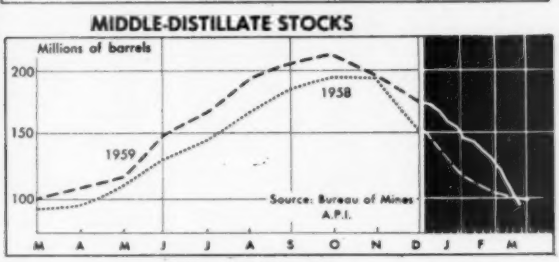


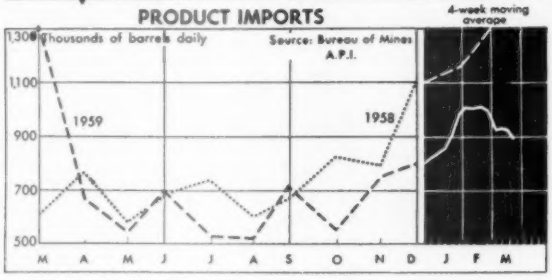

TOTAL DEMAND–ALL OILS
Millions of barrels daily
Source: Bureau of Mines
O. & G. J.–A.P.I.
4-week moving average
1959
1958
M A M J J A S O N D J F M

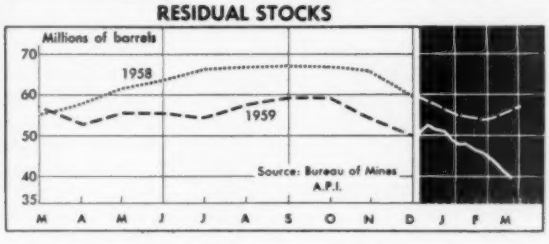












API REFINERY REPORT—MARCH 25, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, March 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,179	548.6	38.7	374.9	181.4	46,319	6,572	24,049	9,607	1,202	534.5	49.1	394.9	191.5
Appalachian:														
District 1	104	39.9	5.7	23.9	13.8	6,425	473	1,820	264	104	41.6	4.6	24.6	10.6
District 2	102	42.0	9.9	16.1	15.9	3,243	312	698	438	103	48.0	8.2	17.2	18.3
Ind., Ill., Ky.	1,450	718.1	74.4	322.7	202.3	43,702	3,047	11,925	3,521	1,519	759.1	72.3	332.3	192.4
Minn., Wis., Dak.	123	62.6	4.7	30.6	21.9	6,831	523	2,502	585	103	50.0	5.4	25.8	10.6
Okla., Kans., Mo.	668	384.1	12.2	161.9	36.3	23,342	715	7,066	891	738	395.8	13.7	184.3	26.2
Inland Texas	278	200.4	12.4	46.0	18.6	7,989	503	1,583	2,372	272	200.4	6.2	41.2	21.9
Tex. Gulf Coast	1,886	924.3	114.0	414.0	160.1	29,022	2,267	9,755	5,311	1,927	925.8	100.4	488.7	181.8
La. Gulf Coast	627	369.4	65.4	128.1	41.3	12,844	1,459	3,320	1,094	700	379.2	31.2	187.5	51.1
N. La. and Ark.	96	45.0	3.0	22.1	5.9	6,052	781	1,998	138	102	49.2	5.0	24.1	6.3
Rocky Mtn.:														
New Mexico	25	15.1	0.7	4.3	3.1	864	43	140	162	25	12.5	.50	4.4	2.5
Other	271	125.9	3.0	62.4	29.6	7,931	200	2,322	826	295	134.6	3.8	63.5	38.6
West Coast	1,136	525.0	31.6	228.1	309.5	31,423	1,204	10,834	14,643	1,117	499.7	5.5	198.9	298.7
Mar. 25, 1960	7,945	4,000.4	375.7	1,835.1	1,039.7	225,987	18,099	78,012	39,852	8,207	4,030.4	305.9	1,987.4	1,050.5
Mar. 18, 1960	7,857	3,958.9	358.7	1,839.1	1,003.6	224,464	18,784	82,442	40,991	.....	.....	.....	.....	.....
Mar. 27, 1959	8,007	4,008.6	257.4	1,897.3	981.0	212,954	17,883	76,672	55,917	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No. Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Jules-burg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

Flat Prices

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.55
Middle District	4.37
Southwest Pennsylvania	4.10
West Virginia	3.92
Buckeye Grade	3.77
Illinois Basin	**3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.90
Iranian, 34.0°-34.9°, Bandar Masur	1.80
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-N. Y., clean (ATRS +12.5%)	$3.21
★ Gulf-N. Y., dirty (ATRS −5%)	2.71
★ Carib.-N. Y., dirty (ATRS −47.5%)	1.44
★ Carib.-UK, dirty (Scale −60%) (13s. 0d.)	1.82

★ Denotes change from previous week.

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):	
Regular (91 octane)	11.00-11.25
Premium (99 octane)	13.50-14.00
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25-10.50
Regular (92 octane)	10.50-10.75
★ Premium (98 octane)	11.25-11.75
California (rack) Los Angeles):	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.125
Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):	
★ Kerosine 42-44	9.25-9.50
★ Diesel oil (58 d.i. and above)	9.00-9.25
★ Distillate No. 1	9.00-9.25
★ Distillate No. 2	8.00-8.25
Gulf Coast (cargoes):	
Kerosine 41-43	8.75- 9.00
Distillate No. 2	7.75- 8.00
New York Harbor (barges):	
Kerosine 41-43	9.8-10.3
Distillate No. 2	8.8- 9.3
Diesel fuel, 48-52 d.i.	9.1- 9.6
Caribbean area (cargoes):	
Distillate No. 2	8.00

Residual Fuel (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.70-1.80
Gulf Coast (cargoes):	
★ Bunker C fuel	$2.10
New York Harbor (barges):	
★ Bunker C fuel	$2.37-2.47
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

★ Denotes change from previous week.

▶ ▶ ▶ Equipment Men Notes

Hugh A. Saye, Jr. assumes post

. . . as assistant marketing manager of the Controls Division of Southwestern Industrial Electronics Co. He will direct activities of sales engineers in oil lease, pipeline, and process-industry automation fields. Saye goes to SIE from Fisher Governor Co., where he managed the CSC Division, specializing in automatic control problems relating to oil and gas production. He has 11 years of experience in automatic control.

Harold H. Mitchler becomes

. . . district manager of Marsh Instrument Co.'s New York office, serving New York and the metropolitan area. Mitchler started with the Skokie, Ill., organization in 1939. Following military service, he spent 3 years at the Marsh home office before being transferred to Charles Kelly Industrial Corp., of New York. There he handled Marsh instruments, refrigeration equipment, and heating specialties up to the time he became New York district manager.

Dowell combines operations

. . . in Kansas with the company's Oklahoma district, according to A. C. Polk, vice president and general manager. L. A. Courter, manager at Oklahoma City, will be responsible for activities in Kansas, Oklahoma, and North Central Texas. F. E. Rugg will continue as operations manager from the Oklahoma City headquarters. P. J. Millar, district sales manager at Farmington, N. M., becomes district sales manager at Oklahoma City. He replaces Dewey D. Tennyson who joins the company's general office sales department in Tulsa.

J. A. Cummin, who has been manager in Kansas since 1935, is assuming a special assignment in Tulsa headquarters. R. E. West, district engineer, will go to Evansville, Ind., where he will continue in the same capacity in the 9-state area headquartered there. D. A. McFarlane, station manager at Great Bend, Kans., moves to Hays, Kans. as manager, replacing H. D. Monical. Monical takes on a new assignment in the company's Amarillo, Tex. district.

B. G. McCoy, district office manager at Wichita, becomes chief district clerk at Oklahoma City; H. E. Persinger, district maintenance supervisor, is being transferred to Oklahoma City where he will supervise all equipment maintenance in the Kansas, Oklahoma, and the North-Central Texas area. All present operating points in Kansas will continue to function. A sales office will be maintained in Wichita with M. E. Johnston in charge.

John V. Glaves is promoted

J. V. Glaves

. . . to district sales manager for mechanical goods at the Houston branch of U. S. Rubber Co. Formerly assistant to this position, Glaves replaces J. Wesley Batten, district manager since 1951, who has retired after nearly 33 years with U. S. Rubber.

The new Houston sales manager has been with the firm for 12 years. He formerly spent 10 years as a member of the company's Tulsa sales staff, operating out of Oklahoma City most of the time.

B. H. Pickard is appointed

. . . administrative assistant on the executive staff of G. J. Duesterberg, president of Plastic Applicators, Inc., Houston. Pickard has had 22 years of oil-field experience, 18 years in pipe-inspection work. He has worked in all phases of inspection including management, sales, and as president of an international inspection company. In this position he gained experience in international trade in the Near East, South America, and Canada.

Gene Schneider joins

. . . the sales force of the Vinson Supply Co. warehouse store at Odessa, Tex., specializing in the servicing of Vinson accounts with oil-country tubular goods, reports B. E. Keeling, vice president in charge of the Odessa branch. Schneider was formerly factory representative in the Odessa area for Axelson Mfg. Co. For 10 years prior to that, he worked in various capacities in the oil industry.

Edward W. Reif is promoted

. . . to sales manager of the Controls Division of Black, Sivalls & Bryson, Inc., according to Charles R. Bootz,

E. W. Reif

L. H. Lutke

division manager. Lee H. Lutke assumes Reif's former post as sales manager of the Oilfield Equipment Division's Midland district.

Reif, who held the Midland job the past 8 years, joined BS&B in 1942. From that time he advanced as salesman, branch manager, assistant regional manager, and district sales manager. He now will headquarter at the division's central offices in Tulsa.

Lutke, during the past 9 years, has spent most of his time in the Permian Basin area where he worked his way up to senior sales representative. He has been with the organization since 1941.

Kemp Barley joins sales staff

. . . of Oil Base, Inc., Compton, Calif., manufacturers of Black Magic and oil-base mud products, according to Thad Randolph, vice president of sales. Barley worked for Gulf, Halliburton, and Baroid before forming his own mud company in California. Two years ago he sold his interest and went to Denmark as head drilling engineer for Kellogg Overseas Drilling Co. Barley will be stationed in Bakersfield, Calif., to serve the San Joaquin Valley.

James E. McDonald is named

J. E. McDonald

. . . manager of mechanical and pressure-tubing products for United States Steel Corp.'s National Tube Division, according to Louis W. Mason, general sales manager. McDonald joined National Tube in 1946 at the Gary, Ind., Works. He became a sales trainee in 1948, and upon completion of the training course, was assigned to the Cleveland sales district. In 1953 he was transferred to the Pittsburgh sales office, where he has been until his present appointment.

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Brewster N3 with 86 ft. portable mast. For sale ready to drill. Capacity 3,500 ft. Includes 4½" drill pipe, mud pump and engine, water pump, light plant, tool house, oil-bath rotary table, drill collars, kellys, traveling block and other equipment necessary to drill. For complete inventory, write: Box L-792, The Oil and Gas Journal, Box 1260, Tulsa, Oklahoma.

HEAT EXCHANGER
3350 Sq. Ft. BRAUN 135PSI, #66510 Type 42-192, 1064-¾" OD Tubes 16 ft. long, 14 Ga., Steel ASTM-A-179 Excellent Condition, LOW PRICE.
S. M. Davis, Box 1407, E. St. Louis, Ill.

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/6"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. I Grade plain end and cleaned.

INDIANA-OHIO PIPE CO.
P. O. Box 5412 Shep. Sta.
Columbus 19, Ohio
Phone CL 3-5527

LIQUIDATION

AMOCO REF. DESTREHAN, LA.

19,000 BBL. MIV CAT CRACKER (1953)

BOILERS, 5—70,000 #/hr. 450 Psi.
HORTONSPHERES, 6—5,000 & 10,000 bbl.
EXCHANGERS, 78 to 4,000 sq. ft.
TOWERS, 3 ft. to 12 ft. diameter.
VESSELS, 2 ft. 3 in. to 15 ft. 6 in. diameter.
FURNACES, 15 MM & 34 MM BTU/hr.
CENT. COMPRESSORS, 38,000, 9,370 & 5,535 CFM.
CENT. PUMPS, 15 to 7,000 GPM.
TURBINES, 5 to 1,400 HP.
TANKS, 1,000 to 80,000 bbl.
ETHYL WEIGHING STATION, 8,500 gal.

BE BRILL ESTABLISHED 1926

EQUIPMENT COMPANY
DESTREHAN, LA.
TEL. NORCO 6571
35-53 JABEZ ST. NEWARK, N. J.
4101 SAN JACINTO, HOUSTON, TEXAS

FOR SALE EQUIPMENT

"PLUS" SAVINGS
on
SURPLUS TUBING & CASING
All J-55 SEAMLESS—U. S. A. Made

100,000'—2" regular 10-rd. thrd. 4.6# @ .45 ft.
50,000'—2" upset 4.6# @ .55 ft.
40,000'—2½" upset 6.4# @ .78 ft.
20,000'—5½" regular T&C 15.5# @ $1.65 ft.
25,000'—7" regular T&C 23# @ $1.95 ft.
10,000'—9⅝" regular T&C 32# @ $2.95 ft.
20,000'—10¾" regular T&C 40# @ $3.79 ft.

For sale at prices quoted . . . or will trade for share in production runs.

BOX L-784, THE OIL AND GAS JOURNAL, TULSA, OKLAHOMA.

CESSNA 195-A, 5 place, 275 H.P. Jacobs, Chrome Wall engine, cross wind gear, complete panel, ADF, omnigater, perfect, low time. Will trade for oil well equipment or casing. Luke Wise, Community Gas & Oil Co., Billings, Montana.

A LIMITED quantity Westinghouse 10 H.P., 1150 R.P.M., 3 phase, 60 cycle, 220/440V, high starting torque, totally enclosed, fan cool, oil well pumping motors reconditioned in our shop, $195.00 each for 1 to 4 motors, $175.00 each 5 or more, F.O.B. San Antonio. Loyd Electric Company, Inc., Phone CA 7-1309.

Natural Gas Compressors (3)
2126CFM COOPER BESSEMER Two Air Cyls. 22½ & 14½ x 14" Stroke, Four Cyl. Engine, 400HP at 330RPM, 1942 Machines very good condition with a bargain price for the lot on East Coast.

S. M. Davis
Box 1407 E. St. Louis, Ill.

PIPE FOR SALE
15,000 ft., 5½" OD-15.5#, J55, Long Coupling
5,000 ft., 7" OD-20#, J55
10,000 ft., 2⅜" OD-4.7#, J55, EUE Tubing
Sucker rods, line pipe, tanks and pumping units.
All No. 1 Grade—Used
29,000 ft., 4½" OD-15.5#, SS, 30 ft. PE Tubing—New
Lundquist Pipe & Supply Co.
325 Wright Bldg., Tulsa, Okla., Phone LU 5-8850

GAS COMPRESSORS

9"x9" Ingersol-Rand ES-1 with MZAU Waukesha engine, fabricated by Wilson & Co., new condition. Maximum discharge on cylinder 100#, $6,000
8"x13" Gardener-Denver, new condition, with brand new Catipillar G 342 Engine. Maximum discharge 750#. Equipped with all extras. Fabricated by IFS, $15,500
4¼"x9" Ingersol-Rand ES-1 with D-1000 LeRoi Engine. Maximum discharge 500#. Fabricated by IFS, $6,000
(Any of the above cylinders could be changed to any desired size and discharge pressure.)

Cylinders only
6½"x11" Ingersol-Rand. Discharge pressure 440#, tested 660#
17"x13" Worthington. Discharge pressure 60#
14"x13" Ingersol-Rand. Discharge pressure 175#, tested 270#
4"x11" Ingersol-Rand. Discharge pressure 1200#
Fabrication of New & Used Compressors.

INDEPENDENT FIELD SERVICE
Phone 5-5163, 253 Agurs, Shreveport, La.

FOR SALE EQUIPMENT

FOR SALE—Approx. 150,000 ft. 6⅝" O.D. 18.97# Used Line Pipe, S. R. L. Bevelled for Welding. Address inquiries P. O. Box 2205, Tulsa, Oklahoma.

1956 MAYHEW 2000 mounted International 190 Tandem, Completely equipped, all tools. $17,500. Located Farmington, N.M. Call or write Bellet, Tulsa, Okla., LUther 2-6291 or P. O. Box 1049.

FOR SALE: Blaw-Knox Packaged Gasoline Stripping Plant, capacity: 5 million cubic feet per day. Complete less storage tanks. Location Central Oklahoma. Okla. Resources Development Co., Box 3966, Okla. City 6, Okla

WELL DRILLS—CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

LIQUIDATION

at ESSO REFINERY Balto., Md.

BLOWERS Cent. 28,000 CFM at 17 Psig.
COMPRESSORS, Clark Gas RA-5; Clark Cent. 7,860 CFM 2 Stage
CONDENSERS 7,500 to 100 sq. ft.
REBOILERS 2,700 to 450 sq. ft.
HEATER TUBES Chrome 4" to 6" O.D.

FLUID COKER 10,000 BBL./DAY

PRESSURE VESSELS 3' to 12' Dia.
TOWERS 2' 6" to 12' Dia.
PUMPS Hot Oil, Steam, Centrifugal
INSTRUMENTS Controllers, Recorders Indicating & Transmitting

WRITE FOR CATALOG

HEAT & POWER CO., Inc.
60 E. 42 St., N.Y. 17, N.Y.
306 Thompson Bldg., Tulsa 3, Okla.
Boston & Haven St., Box 5203, Baltimore 24, Md.

FOR SALE EQUIPMENT

1 BUCYRUS—ERIE 36L Spudder, late model. Rig complete with tools and equipment. Cassel Drilling Co., Inc., Dumas, Texas. Phone WE 5-5019 or WE 5-4369.

FOR SALE OR LEASE: Three (3) large perforating trucks complete with 16,000' of 7/16" single conductor line. These units are ready for the field. Box L-814, The Oil and Gas Journal, Tulsa, Oklahoma.

For Sale or Trade

80,000'—30" O. D.

NEW STEEL PIPE

.312", .344", .375", .406" walls

Double Random Lengths

UNTESTED

$94.00 ton, loaded

TESTED

$118.00 ton, loaded

Use for lines,

casings, pilings, irrigation

Will sell all or part or will trade for surplus pipe or for interest in your project.

Large stock other sizes, also, 2" to 36" O. D.

Call us for prices, terms, delivery

VALLEY STEEL PRODUCTS CO.

PRospect 3-3020

124 Sidney St. St. Louis 4, Mo.

FOR SALE

Petroleum refinery in full operation, south of the city of Antwerp and in the vicinity of the port.

Description:

1. Site of 14,8 acres where of 4.784 sq. yards, office building, workshop, storehouse, pump and control houses, rail facilities, etc.
2. Petroleum distillation plant of 2,500 Bbl./day capacity.
3. Two steam boilers of 113,8 Lbs./sq. inch pressure, oil heated.
4. Six steam heated redistillation stills.
5. Sulfuric acid treating facilities.
6. Complete butane recovery equipment, including tankage, compressor, distillation tower and accessories.
7. 50 tanks having a total capacity of 18,900 US barrels, with pumping facilities.
8. Complete loading rack for tank cars and trucks.

Write to:

BOX L-785

THE OIL AND GAS JOURNAL

TULSA, OKLAHOMA

EQUIPMENT WANTED

WANTED: Gardner Denver 5 x 10 pump, with high pressure fluid end. Also Triplex Plunger pumps. Write P. O. Box 65, Clarkwood, Texas.

HELP WANTED

WANTED

PRODUCTION SUPERINTENDENT

or

PETROLEUM ENGINEER

Must be experienced in all phases of production, water-flooding, drilling, well completion and workover in Oklahoma. Salary open. Address reply: Box 1160, Tulsa, Oklahoma.

HELP WANTED

PIPELINE COST Estimator—full time, part time, or consulting. Reply to D.K. M., P. O. Box 35067, Dallas, Texas.

"MEASUREMENT SUPERINTENDENT; responsibility includes repair, adjustment and testing of domestic and industrial meters, regulators, pressure volume correctors, etc. Also, fabrication and installation of industrial meter settings. Must be experienced and aggressive. Send details of experience and compensation. Location Great Lakes Area." Box L770, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $6.00 cash. OIML Co., Box 2603, Tulsa, Oklahoma.

ESTIMATOR—Pressure Vessels and Heavy Steel Fabrication. Familiar with A.S.M.E. Codes. Growing Company. Send resume to: Cherokee Steel, Inc., P. O. Drawer 1049, Tulsa, Okla.

TRANSLATORS, Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N.J.

Representatives wanted by manufacturer of production equipment for Rocky Mountain, Four Corners, Illinois, Michigan, South America and Mexico. Give list of accounts now handled and method of coverage. Box L-779, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGISTS

Medium size integrated oil company has openings for two capable geologists between 28 and 40 years of age. One must have varied experience in south Louisiana; the other in south Texas area. Salary range of $9,000 to $13,000. Submit resume, including references, recent photograph and salary requirements to:

BOX L-783

THE OIL AND GAS JOURNAL

TULSA, OKLAHOMA

All replies are strictly confidential, and our employees know of this advertisement.

OVERSEAS OPPORTUNITY

Oil Company operating in Libya has opening for experienced WAREHOUSEMAN-CLERK. Must be thoroughly familiar with drilling and production equipment and supplies and be able to train and supervise native personnel. Will be required to set up and maintain perpetual inventory records. Ability to type essential. Write P. O. Box 1262, Dallas, Texas, giving age, marital status, and complete and detailed resume of education and experience. Enclose small snapshot.

REFINERY MAINTENANCE: Two men, one possibly for Maintenance Superintendent, with several years general experience in all phases refinery maintenance: covering, welding, pipe fitting, pump and compresser repairs, instrument, electrical, boiler making, rigging, etc. Mechanical Engineering Degree desirable but not necessary if otherwise qualified. Must be capable of doing work in the crafts themselves, also organizing, training, and supervising our Puerto Rican employees. Salary commensurate with experience and ability. Make application to E. G. Case, Vice-President, Manufacturing, Caribbean Refining Company, Box 2988, San Juan, Puerto Rico.

SITUATIONS WANTED

GEOLOGIST, 29, MS, 5½ years varied experience in exploration and production geology in Rocky Mountain Area and Venezuela. Box L-790, The Oil and Gas Journal, Tulsa, Oklahoma.

Engineers with experience in the design, construction, and maintenance of Storage Facilities for Underground L.P.G. products in salt domes. Desire work in the consultant capacity for lump sum or percentage of Cost.

BOX L-791,

THE OIL AND GAS JOURNAL

TULSA, OKLAHOMA

SITUATIONS WANTED

GEOLOGICAL Engineer, 36, family, 15 years varied exploration experience, including some foreign, mining, and hydrodynamic work, speaking fluent French, working Spanish, seeks position, domestic or foreign, expenses & interest only, if preferred. Box L766; The Oil and Gas Journal, Tulsa, Okla.

COMMERCIAL PILOT, 27 mel instrument 2,900 hrs. B-25, Convair, military obligation complete. BA ECO 1954 desire challenging position—executive pilot—public relations—available immediately. L. R. Kuhnell 7051 Twin Hills, Dallas, Texas, EM 1-1427.

PETROLEUM ENGINEER, also qualified as geologist. 17 years of responsible domestic and foreign experience. Speaks French and Spanish. Desires senior technical or administrative position in foreign operation of producing company. Box L-776, The Oil and Gas Journal, Tulsa, Oklahoma.

ADMINISTRATIVE secretary, 39, single, 10 years experience with major Venezuelan oil producer; desires relocate Latin America, but will consider other foreign employment. Box L-753, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER: B.S., 33, married; 8 years experience. Waterflood evaluation, design, installation, and operation. Primary completion and operations. Box L-717, The Oil and Gas Journal, Tulsa, Oklahoma.

YOUNG ENGINEER, Wide practical experience, knowledge petro-chemicals and analytical instruments; Seeks challenging Sales/Engineering post. Will relocate internationally. Box L-769, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN-ATTORNEY, 5 years experience all phases Petroleum Land Work including titles, contracts, units. Seeks higher position. Now employed. Young, married, veteran. Box L-788, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES OR SALES Management: 18 years selling to drilling-production accounts, diversified equipment. Mostly Mid-Continent area. Management and administrative experience. Engineering background. Age 38. Presently employed. Box L-789, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION SUPERINTENDENT, 30 years experience, rotary cable tool drilling, completions, workovers and lease work. Will work on steady or consulting basis. Box L-786, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER: 10 years major company field and staff assignments, including valuation, design and operation of water floods; unitization, reservoir engineering, commission work; and field problems and studies. Box L-787, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER, 42, married. 8 years foreign pipeline and construction experience in Middle East and North Africa. 16 years experience in refinery operation and construction domestic. Desire managerial position for major contractor or oil company in foreign operations continent or Libya. Presently employed. Box L-793, The Oil and Gas Journal, Tulsa, Oklahoma.

NATURAL GAS—

REFINING ENGINEER—

ECONOMIC ANALYST

Degree, 16 years balanced experience, domestic and foreign. Process design, natural gas, gasoline and refining operations. 4 years supervision engineering economics group—management services, evaluation, process selection, coordination, planning and economic justification of natural gas and petroleum processing facilities. Negotiation and analysis of purchase, sale, processing and joint venture agreements. 3 years coordinator of natural gas and natural gasoline operations with Venezuelan major. Supervision of operation and maintenance, off-shore gas turbine-centrifugal compressor, gas injection and absorption facilities.

710 Wayne Drive

Bakersfield, California

LEASE AND DRILLING BLOCKS

Oil Property Management, Lease evaluations, completion and workover supervision —Permian Basin and South Eastern New Mexico. Bee Engineering, P. O. Box 5321, Village Station, Midland, Texas.

MONTGOMERY County Kansas, 80 acres partially proven, 750 ft. Bartlesville Sand. For logs write Box 121, Pawhuska, Oklahoma.

14 OIL WELLS, 5 water injection wells. 560 acres. Production, approximately 20 barrels daily. 700 ft. depth. On pipeline. Engineers say drilling additional wells will make a money making, long lived flood. Southeast, Kansas. Box L-715, The Oil and Gas Journal, Tulsa, Oklahoma.

I WISH TO assign 400 acre lease in north Ohio Co. Kentucky known as the "Ward Farms," 2 miles north of Hartford on Hwy. 71. Write or call: Alfred Bonn, R.R. 1, or phone GA 3-7045, Harlengen, Texas.

CAPITAL NEEDED TO drill offset, to production in Montgomery County, Kansas. Will definitely drill to Wilcox at about 1,100 ft. Will test Bartlesville at about 750 feet. Charley C. Murphy, Box 8, Cherryvale, Kansas.

PROSPECTIVE OIL Land: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F. M. 1437 Highway, south of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

OIL AND GAS LEASE: 12 sections, 9,016 acres approx. 20 year lease. Geology easily visible S.W. of Vernalis production. Open for bid. To close bids—June 30. Royalty to landowner—one eighth. $1.00 an acre per year unless drilled. Dr. Clarence Farmer, 110 Sycamore St., Manteca, Calif.

WE FILE YOUR APPLICATION

for 640 or 2,560 acre—5 year oil, gas leases on U. S. Government owned lands in any state of your choice.

JOHN L. DONAHUE
430 16th Street Denver 2, Colorado

SECONDARY RECOVERY

Lab analysis of cores from recent well indicate 10,000 to 20,000 barrels of pipe line oil **per acre** left in formation after primary **producing** period. Depth 1600'. Can be flooded, **repressured** or mined. This is not an offer for sale.

IMPERIAL-CRAIG CO.
Kevin, Montana.

BUSINESS OPPORTUNITIES

FINANCIAL Contacts, Underwriters, Private Brokers reached. No shopping. Confidential. Send details to Consultant—817—51st Street, Brooklyn, N. Y.

HAVE OIL AND GAS property, will exchange for investment stock in small reliable corp. Write: Box L-757, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION Manufacturers: We have an Oil Tool Rental business with stores in Fillmore, Woodland, and Bakersfield, California. We have complete coverage of the oilfields of California with sales and service and would like to become the manufacturer's representative for several good oilfield lines. Rental Tools Corporation, P. O. Box 808, Bakersfield, California, Phone FA 4-9438.

FEDERAL OIL LEASES

You can benefit by our more than 25 years experience in your purchase of oil and gas leases. All leases chosen for good geological location where major companies are active. Parcels of 80 acres or more. Terms as low as $40 down, $20 per month for 9 months. 30 day money back privilege. Good inflation hedge. Free maps. Complete details. Write now.

ATLAS OIL SURVEY
Dept. OGJ-4, Colorado Bldg.
Denver 2, Colorado

BUSINESS SERVICE

DELAWARE CORPORATIONS formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

PRODUCTION FOR SALE

THIRTY WELLS in North Lima field on 3 leases in Ottawa County and 1 lease Sandusky County, Ohio. Write John W. Richards, 106 Fifth Street, Genoa, Ohio.

PRODUCTION WANTED

DESIRE TO PURCHASE NATURAL GAS

From shut in Gas Wells, flared or Casinghead Gas anywhere.
Reply giving location and daily volume available.

Box L-774
The Oil and Gas Journal
Tulsa, Oklahoma.

LEGAL

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that 38.71 acres of land in one parcel within the undefined known geologic structure of the Tar Creek field, Wilkinson County, Mississippi, will be offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 1:00 p.m., E.S.T., April 27, 1960 when bids will be opened. Full details of the lease offering and how and where to submit bids may be obtained from the Manager, Eastern States Land Office, Bureau of Land Management, Washington 25, D. C. H. K. Scholl, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 153.35 acres of land in two parcels within the known geologic structure of Moffat Field, Moffat County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., May 20, 1960, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. Dale R. Andrus, Land Office Manager.

More discovery wells

(Continued from page 169)

24-25n-9w. IPP 190 BOPD, 39°, Graneros 6,320 ft. TD 6,652 ft. New pool, Graneros discovery.

NORTH DAKOTA

Bowan County:
Shell Oil Co. 41-23 "A" Government-Unit, C NE NE 23-130n-107w. IPP 41 BOPD, 16 BWPD, 28.7°, Red River Ordovician 8,195 to 8,277 ft. TD 8,930 ft. New field.

Renville County:
The California Co. 1 D. W. Laughlin, C NE SE 18-158n-81w. IPF 160 BOPD, 20/64-in. choke, 29°, Mission Canyon discovery, new field. TD 4,517 ft., perfs. 4,512-17 ft. Opens new field in Glenburn area.

OKLAHOMA

Beaver County:
Stekool Panhandle, Ltd., 1-26 Lane, C SW SW 26-2n-21eCM. IP 714 M.c.f.d., Morrow 7,623-99 ft. TD 8,109 ft. New field.
Stekoll 1A-28 Dyer, 28-6n-27eCM. IPF 160 M.c.f.d., Morrow 6,090-6,107 ft. TD 6,623 ft.
Sinclair Oil & Gas Co. et al. 1 W. T. Potter Unit, C NW SE 33-3n-23eCM. IPF 1,254 M.c.f.d., Chester 7,414-32, 7,434-37, 7,440-48 ft. TD 7,525 ft.
Oklahoma Natural Gas Co. et al. 1 Kenneck, C NW SE 17-3n-24eCM. IPF 11,300 M.c.f.d., 23 BDPD, Morrow 7,042-58 ft. TD 7,560 ft. New field.

Canadian County:
Cities Service Oil Co. 1 Porter "B," NE SW 5-12n-8w. IP 8,900 M.c.f.d., Bromide 12,340-475 ft., McLish 12,624-744 ft. TD 13,366 ft. New field.

Cimarron County:
E. K. Carey Drilling Co. 1 Mathis, C SW SE 13-6n-8eCM. IP 96 BOPD, Morrow 4,640-46 ft. TD 4,662 ft. New field.

Dewey County:
Calvert Drilling Co. Inc. 1 Joy, C NE 30-18n-17w. IP 1 M.M.c.f.d., Morrow 10,185-10,279 ft. Oswego 8,680-8,787 ft. TD 10,543 ft. New field.

Garfield County:
G. O. Bain et al. 1 Allen, 16-22n-3w. IP 40 BOPD, 45°, Reagan 2,024-30 ft. TD 2,060 ft.

Kay County:
D. L. Sampson 1 Standing Buffalo, SW SW SW 14-25n-2e. IP 50 BOPD, 41°, Layton 2,824-36 ft. TD 2,836 ft.

Kingfisher County:
King-Stevenson Oil Co. and Calvert Drilling Co. 1 Grimes, C NW SW 32-19n-6w. IP 300 BOPD, 34°, Red Fork 6,626-42 ft., Manning 6,778-6,824 ft. TD 7,270 ft. Manning and Red Fork discovery.

Latimer County:
Sinclair Oil & Gas Co. 1 A. H. Reneau, C SE NW 32-3n-20e. IP 1,850 M.c.f.d., Big Fork chert 2,340-2,410 ft. TD 7,097 ft. Gas discovery.

Lincoln County:
Woods Oil & Gas Co. 1 Mattie Tull, NW SE NW 35-13n-6e. IP 4,224 M.c.f.d., Hunton 4,187-91 ft., 4,193-96 ft., 4,201-06 ft. TD 4,239 ft. Shut in gas discovery.

McClain County:
Fain-Porter Drilling Co. 1 Calvert, SE SE SE 2-6n-3w. IP 20 BOPD, Hunton 8,329-54 ft., 40°, TD 10,108 ft. New field.

McIntosh County:
Bell Oil & Gas Co. 1 Young Estate Unit, SW SE NE 11-11n-18e. IPF 1,040 M.c.f.d., Atoka sand 902-912, 931-941 ft. TD 2,380 ft.

Okfuskee County:
W. A. Fleming 1 Golden, NW SW NW 2-10n-10e. IP 1,800 M.c.f.d., Skinner 1,758-68 ft. TD 1,882 ft.

Pottawatomie County:
Ashland Oil & Refining Co. 1 Stovall, C SE NE 5-8n-2e. IP 210 BOPD, 35°, Hunton 5,138-52 ft. TD 5,233 ft.

Texas County:
Republic Natural Gas Co. 1 Jacobs "E," C SE NW 25-5n-13eCM. IP 55 BOPD, 38.3°, Morrow 6,166-70 ft. TD 7,075 ft.
Hamilton Bros. 1-16 Carl E. Dailey, C SE NW 16-5n-5eCM. IP 11,800 M.c.f.d., 30 BCPD, Morrow 6,120-30, 6,140-60 ft. TD 6,680 ft. New field.
Shell Oil Co. 1 Fisher, C NW SE 20-4n-16eCM. IP 11 BOPD, Morrow 6,555-66, 6,606-18 ft. TD 6,986 ft. New field.

SOUTHWEST TEXAS

Hidalgo County:
Appell Petroleum Corp. 1 Moore, Lot 23, Hammond Subd., Block 1, Porcion 64, 1 mile north of McAllen. AOF 4,350 M.c.f.d., GLR 140 M.c.f. per bbl., 62°, shut-in TP 2-475 psi., 7,053-58 ft., Frio. TD 7,601 ft. New pay in West McAllen field.
W. E. Bakke 1 McManus, LaBlanco

Grant, 5 miles south of Donna. AOF 2,200 M.c.f.d., GLR 69.1 M.c.f. per bbl., 64.1°, shut-in TP 2,583 psi., perf. 6,513-21 ft., Frio. TD 8,623 ft. New-field discovery 1 mile southeast of Landa field.

Jim Hogg County:

Sun Oil Co. 61 A. C. Jones, Agua Nuevende Abajo Grant, 29 miles northeast of Rio Grande City. IP 21 BOPD (net), 15.3% water, ¼-in., 42.6°, GOR 10,443 cu. ft. per bbl., TP 200 psi., perf. 5,648-52 ft., 5,656-60 ft., and 5,677-81 ft. TD 6,430 ft. New pay in Jones field.

Gilcrease Oil Co. 2 Erna Schacherl, Block 13, J. J. Gallagher Subd., Casa Blanca Grant, A-296, 4 miles east of Orange Grove. AOF 11 M.M.c.f.d., GLR 200 M.c.f. per bbl., 63.8°, shut-in TP 1,702 psi., perf. 4,578-83 ft., Frio. TD 4,650 ft. New-field discovery.

Gulf States Development Corp. 2 Moser-Goldapp, Block 19, O. S. Joseph Oil & Gas Subd., La Vaca Grant 166, 1½ miles south of Alice. IP 59 BOPD (net), 27% water, ¼-in., 23°, TP 55 psi., perf. 3,675-79 ft., Frio. TD 5,464 ft. New pay in Tom Graham field.

TEXAS GULF COAST

DeWitt County:

Shell Oil Co. 1 William M. Carroll, C. P. Delmas Sur., A-157, 4 miles southwest of Hope. AOF 13 M.M.c.f.d., GLR 62.5 M.c.f. per bbl., 44.4°, shut-in TP 7,025 psi., perf. 11,187-203 ft., Wilcox. TD 19,765 ft. (New-reservoir discovery in Brushy Creek area—South Texas' deepest test and District 2's deepest Wilcox production.)

Fayette County:

Earl R. Anslin and Albert Mikeska 1 Rudloff, John Rice Jones Sur., A-59, 7 miles northeast of Fayetteville. AOF 112 M.c.f.d., dry gas, TP 71 psi., perf. 7721½-75 ft., Oakville. TD 196 ft. New field.

TEXAS PANHANDLE

Carson County:

Texas Gulf Production Co. 1 Bobbitt, Sec. 95, Blk. 2, TTRR Sur., 5 miles northwest of Panhandle, 7 miles southwest of Panhandle field. IPCAOF 9,500 M.c.f.d., Brown dolomite 3,247-3,400 ft. TD 4,765 ft. Gas discovery.

WEST CENTRAL TEXAS

Brown County:

Sunray Mid-Continent Oil Co. 1 Ruby Shelton, 1 mile northwest of Grosvenor, Sec. 36, HT&BRR Sur. IPP 35 BOPD, 40°, Fry sand 1,457-73 ft. TD 3,034 ft. New oil discovery.

Callahan County:

Tilton Oil Co. 11-23 J. W. McFarlane, IPF 22 BOPD, 16/64-in. choke, 44°, 1,220-30 ft. 8 miles north of Baird in Sec. 23, ETRR Sur. TD 1,266 ft. New oil discovery.

Coleman County:

W. L. Vaughn 1-A W. L. Vaughn, Bond & Sanders Sur. 81, IPP 18 BOPD, open hole, 36°, top pay 954 ft. TD 956 ft. New oil discovery.

Taylor County:

Roark & Hooker 1 Jay Ivey, 2 miles east of Tuscola. Luke Bryan Sur. 409. IPP 36 BOPD, 39°, Cisco 2,768-76 ft. TD 2,841 ft. New oil discovery.

WYOMING

Carbon County:

Sohio Petroleum Co. 1 Unit, NW SE 12-16n-92w. IPF 10,965 M.c.f.d., and 40 bbl. condensate per day. Frontier 8,510-45 ft., Nugget 9,630-50 ft. TD 11,265 ft. Opens Cow Creek Unit.

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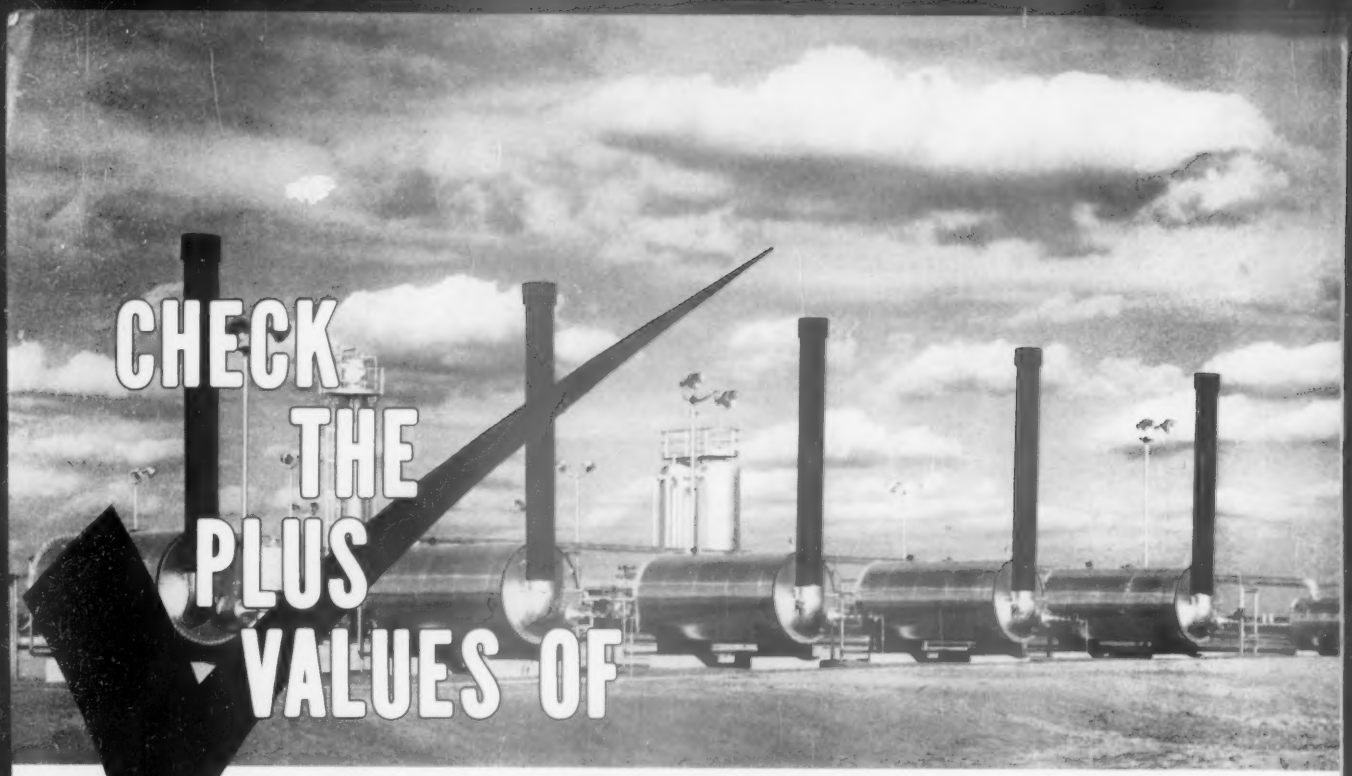

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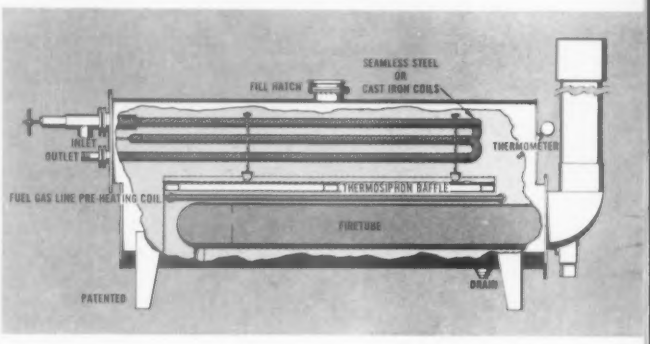

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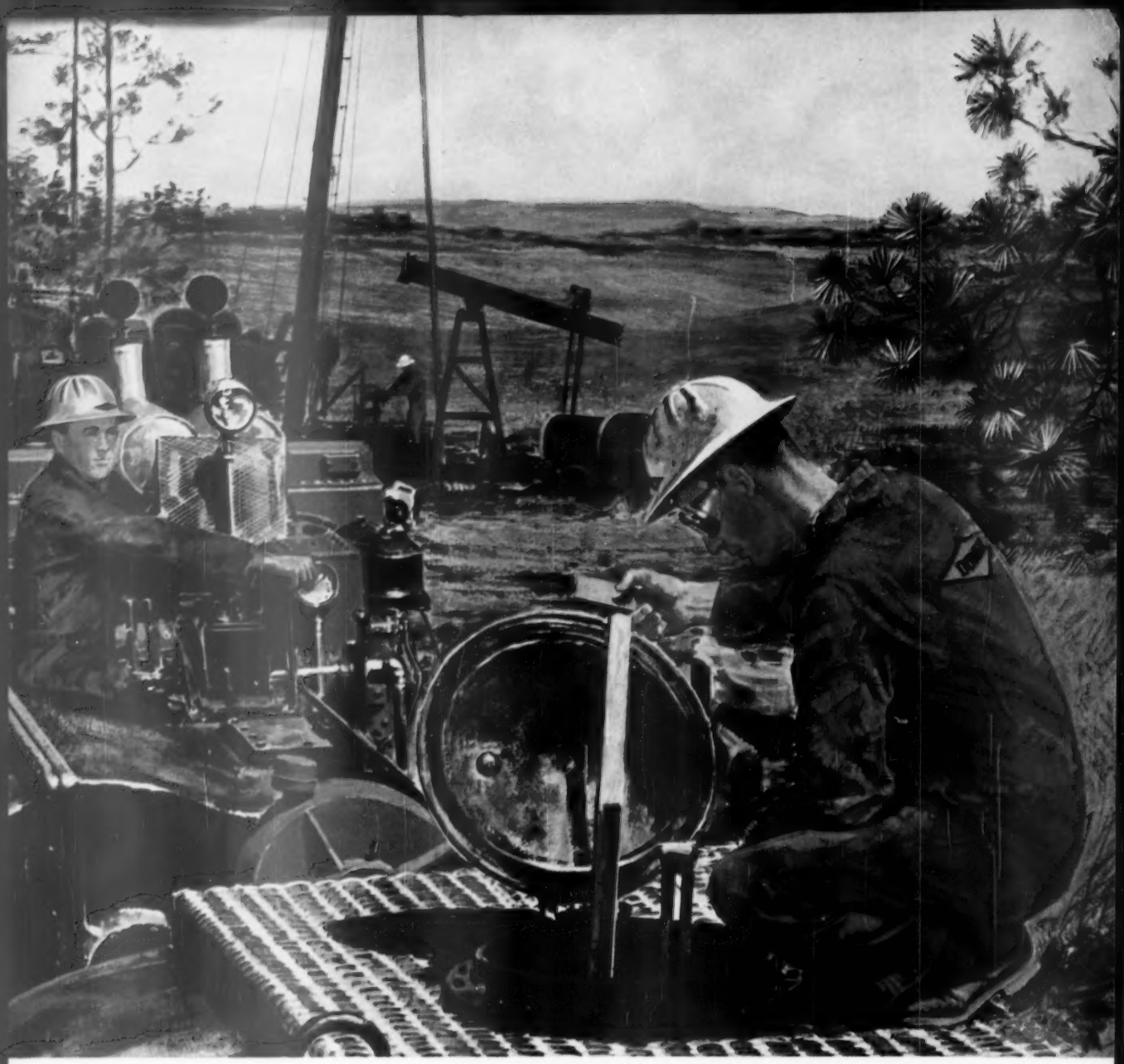

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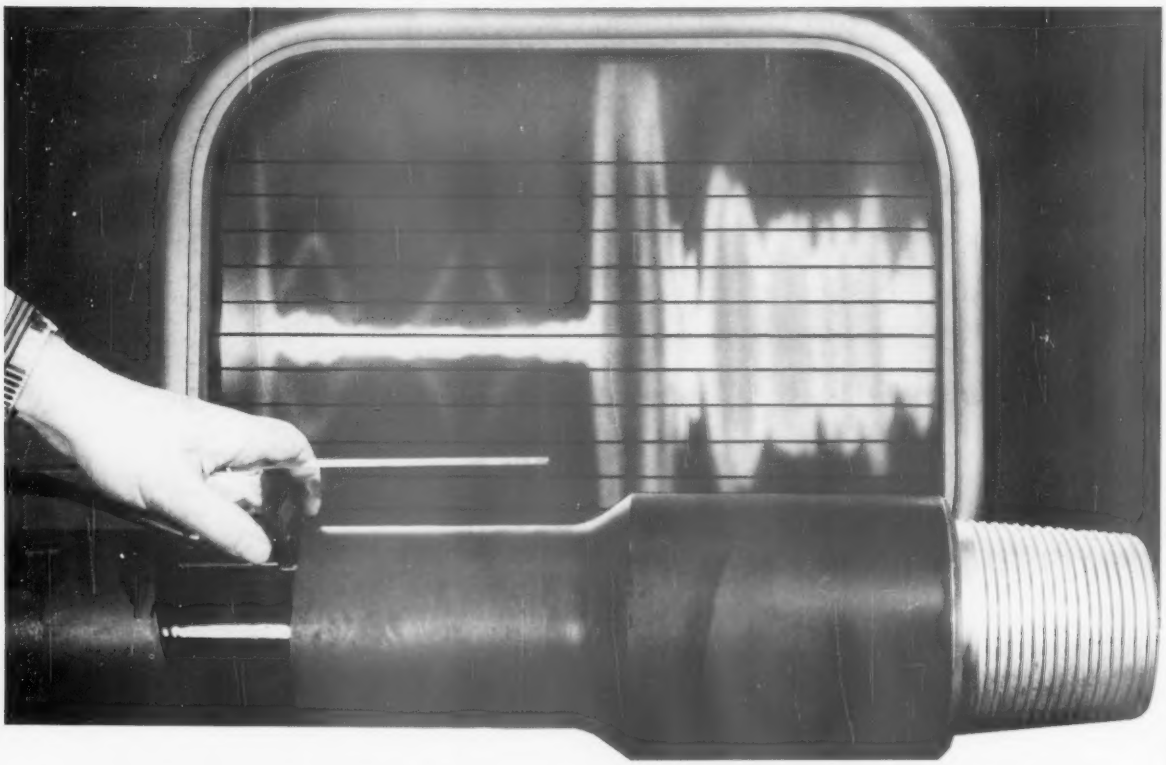

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